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Measuring Machines.

One of the most important advances in the shop practices of this country has been the gradual adoption of implements for precise measurements, because they affect, not only the cost of production, in which proprietors are interested, but the "status," if we may so term it, of hand skill among the operators. At one time, good designs and the better class of machine fitting were confined to certain cities, but now both are to be met with everywhere—in fact bad fitting is the exception.

This change has occurred in many shops using the same machine tools as formerly, and can only be ascribed to improved methods in the small tools employed and also to a more general knowledge, among the workmen, of what Prof. Sweet, some years ago, termed "mechanical refinements." These radical changes, from our personal observation, seem to consist in producing flat or plane surfaces by scraping instead of grinding; better means of making holes; hardened steel mandrels; gauges to standard sizes; measuring machines; a more general system of shop drawings, etc.

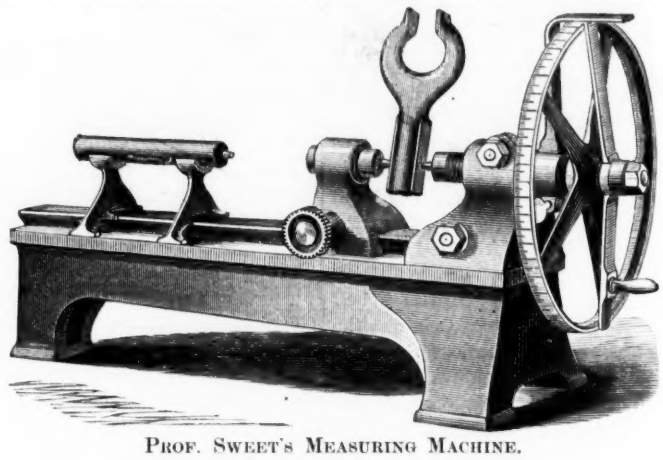
Many workmen have to-day a knowledge of conditions in machine fitting, to mention which some years ago, would probably have brought ridicule upon them.

They can discuss the changes in cast-iron frames and parts, due to different temperatures; the theory of surface plates—and that when properly finished they do not adhere because of the exclusion of air between their surfaces, but because of molecular attraction and that similar results are obtained whether in a vacuum or not; talk of ten-thousandths of inches with the same freedom that hundredths were mentioned at one time; astonish you with theories of the irregular alterations in pieces of steel when hardened, due to carbon percentages, and probably finish with an allusion to the fact that the attempt to establish original standards, by reference to any natural basis, such as the length of a degree of the meridian on the earth's surface in an assigned latitude, or the length of a pendulum vibrating seconds in a specified place, "didn't work."

Most of the conditions relating to workshop standards and measuring appliances were the subject of study by Bodmer and Whitworth, about thirty years ago, at Manchester; since when but little has been added, if we except the hexagonal form of surface plate recently patented by the latter. In 1856, Mr. Whitworth exhibited his machine for indicating differences in inch bars, to the one-millionth part of an inch, and later constructed simpler machines indicating only ten-thousandths, intended for use in shops.

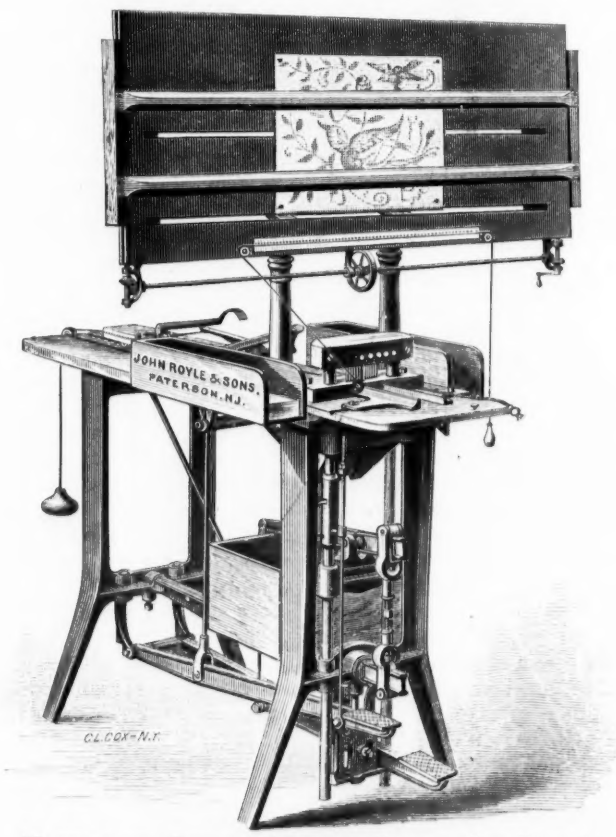
The application of measuring machines to shop practice does not appear to have been the object of Whitworth's investigations; but rather to determine the correctness of his theory of the sense of touch being more reliable than the sight, for the reproduction of original standard length bars.

At this time the committee for restoring the Imperial Standard, destroyed by fire in 1834, were engaged in their operations. The magnitude of this work may be estimated from the fact of the number of micrometer readings for all the comparisons exceeding two hundred thousand, and extending over ten years of time.



PROF. SWEET'S MEASURING MACHINE.

The form adopted for the *standard of length*, and for all its copies, was that of a metal bar, 38 inches long and 1 inch square in transverse section. A cylindrical hole $\frac{3}{8}$ inch in diameter, was sunk near each end to a depth of $\frac{1}{2}$ inch; a second hole was then bored at the bottom of the larger one for the reception of a gold plug forming a table $\frac{1}{10}$ inch in diameter, on which three fine lines were engraved at intervals of $\frac{1}{100}$ inch in directions transverse to the length of the bar. The measure of the standard was given by the linear intervals between the middle transversal lines on each of the gold plugs. The object of engraving the lines which determine the length of a standard on prepared surfaces lying at the bottom of an excavation, instead of on the surface, is to eliminate the error caused by any accidental small flexure.



MACHINE FOR CUTTING JACQUARD CARDS.—(SEE PAGE 2.)

To compare standard bars of this kind, microscopes were used, the part under observation being at the center of the line in every case. The apparatus consisted of two microscopes, carrying micrometers, and firmly supported upon large squared stones built upon a massive foundation of masonry.

The report of the committee on their comparisons showed that certain discrepancies occurred by this system of measuring, the principal cause being that different observers had a *personal equation* in the microscopic observations of the engraved lines, and the results varied more than the probable error to be inferred as existing in the length standard.

For this reason, it is supposed, Mr. Whitworth advocated his system of end measures, and the use of the sense of touch, instead of sight. He pointed out at a meeting of engineers at Glasgow, in 1856, that if any object be placed between two parallel true planes, adjusted so that the hand can just feel them in contact, it will be found that on moving the planes, only the fifty-thousandth of an inch, nearer together, that the object is *distinctly tighter*, requiring greater force to move it between them. To explain this principle he had prepared his machine, employing what he termed a "feeler," consisting of a flat piece of steel interposed between the measuring points, and the length bar being tested. He showed conclusively, that the movement of one-millionth of an inch was sufficient to suspend the gravity piece or "feeler," which, before the adjustment, would fall by its weight.

We have, therefore, in this method of measuring, all the accuracy that can be desired; and in its application in the shop, it is easier to work to the ten-thousandth of an inch, from standards of end measure, than to the one-hundredth of an inch from lines on a scale.

Thus we see that measuring machines for use in machine fitting have been constructed and used for nearly forty years in England.

In this country, the credit of the first attempt to make measuring machines for practical use in producing standards, we think, is due to Prof. John E. Sweet. During the time he was connected with the Cornell University, he had given the subject of standard sizes his constant attention, and contemplated the manufacture of caliper gauges in the work-shops connected with the university. In making the measuring machine, he carried out Mr. Whitworth's idea of feeling the contact; but in a form we think an improvement, by interposing friction between the hand and index wheel, adjusted so that upon a certain pressure being exerted at the measuring points, the screw would come to a stop, while the friction piece could move further. He also suggested making the nut and screw of the same length, as a means of eliminating the error constantly found in the pitch of screws for measuring.

The project of manufacturing these implements was abandoned, owing to Prof. Sweet shortly after resigning his position in the university, and starting the manufacture of his Straight Line engine.

It is to be regretted that the machine designed by Prof. Sweet, and shown in the engraving accompanying this article, is not manufactured and sold, as its extended use would aid our mechanical progress in no insignificant degree. We must, however, accord well deserved credit to Mr. John Richards and his son, who, following somewhat in the course of Mr. Whitworth, put forth their strongest efforts in urging upon American shops the adoption of standard measuring machines and gauges, and producing them at prices which would sanction their widespread use.

Mr. Richards, Sr., made his first experiments at Columbus, Ohio, in 1860, and continued working at times on the subject until 1873, when operations for the first time were begun at Philadelphia. Having, prior to this time, during a visit to England, learned of the perfection with which this manufacture was carried on there, special investigations were undertaken by his son in the matter.

Aside from the many minor improvements made by these gentlemen, both in the arrangement of the implements, and special machines for their manufacture, the most important step forward in the art of measuring by screw movements, was the *correcting* of errors in the aggregate and relative

pitch of the screws employed in measuring machines.

Before this the screws in such machines were made to have but a slight movement, never exceeding an inch, and generally much less, to avoid the almost mechanical impossibility of reproducing screws that are uniform and accurate in pitch. To measure distances, greater than one inch, a sliding headstock was used and set approximately to test bars of different lengths. As soon as the feature of setting the machine to an original standard, and assuming this as a basis to work from is brought in, the element of *determining* sizes is lost and the machine is transformed into a calipering machine.

The Messrs. Richards, in constructing their original measuring machine, obtained original screws from J. Whitworth & Co., and the errors found in the screws when placed in the machine, and the experiments in determining such error, extending over a year's time, gave rise to a plan of *converting* screws of approximate accuracy into perfect measuring screws, regardless of their length. Thus, instead of depending upon standard gauges and test bars to set the measuring points before determining a definite size, the measuring points are moved accurately over their whole range from a fixed or original base generally called a *contact*.

To attempt to explain this curious proposition, diagrams should be used, but the principle can be explained without reference to mechanism.

We will suppose, for sake of illustration, that a screw with ten threads per inch is fitted with a sliding nut on one end, and an index wheel on the other, with one hundred divisions on its periphery—each division would then represent one-thousandth of an inch longitudinal movement of the nut. To move the nut one inch would require ten revolutions of the screw. We will farther suppose that the first inch of the screw is one-thousandth inch, the second inch two-thousandth inch, and the third inch three-thousandth inch *short*; then the screw should make respectively one one-hundredth, one two-hundredth, and one three-hundredth revolutions to move the nut exactly the same distance in each inch of its movement. To set forth these variations of the pitch of the screw, auxiliary scales are used, based upon testing the screws in the machines after they are fitted carefully, by means of original length standards.

As this is done at certain temperatures and by repeated tests, the machines are no longer to be regarded as calipering machines, set to contact with test bars, but as machines to *determine* sizes with accuracy.

The attention of our readers has been called to the subject in a general way, but we hope from time to time to mark the advances being made in this important branch of manufacture in this country.

Improved Piano Card Cutting Machine.

The engraving shown on our first page represents a machine for punching the pattern cards, or designs, for Jacquard looms for weaving ornamental designs.

This machine has, in addition to the well-known devices of those in common use, other new ones which render it more convenient and efficient.

The card guide is universal and self-adjusting to any width of card.

By means of this guide the cards are guided centrally with the peg hole.

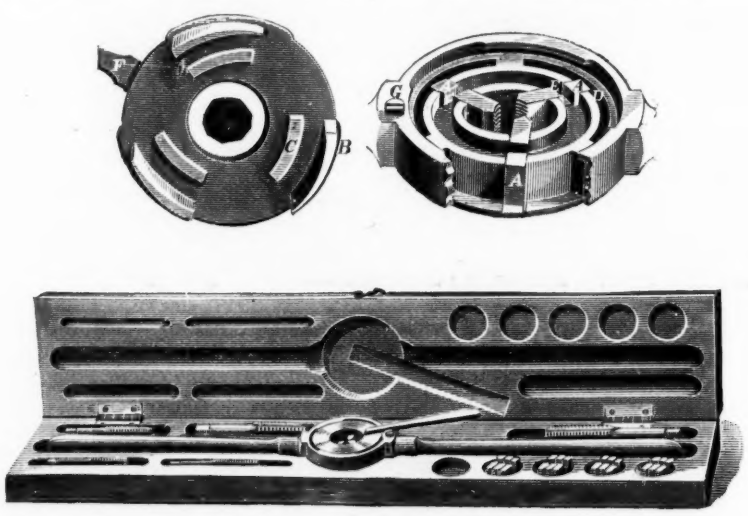
The long pistons having bearings in the upper rails of the front leg, being firmly secured to the punching head, give it a rigidity that could not otherwise be attained. The guide rulers upon the reading board are moved across the pattern with screws, which are connected by gearing, and operated by means of a hand wheel or crank, shown at the lower edge of the reading board. The cutting pedal is connected direct to the punching head, while the cutting lever has an adjustable fulcrum, by the changing of which the machine may be made more or less powerful. Both pedals are provided with an adjustable stop, so that the shortest possible motion may be secured. An accurate vertical adjustment of the punch head may be readily made by means of a right and left hand screw. All these adjustments, together with one for the "skip," are conveniently arranged on the front of the machine. The cuttings from the cards are caught in a portable box underneath the machine. Convenient boxes are arranged at the sides of the machine for the reception of cut and uncut cards, which, together with the reading board, may be quickly detached when necessary. The machine is made almost entirely of iron, and is very strong. It weighs 350 lbs., and will cut cards for from a one-hundred to a nine-hundred Jacquard. The punches and keys are made of the best steel.

These machines are manufactured by John Royle & Sons, Paterson, N. J.

Barnes' Open Die Plates.

The new die plate, shown by engravings on this page; cuts a full thread by passing over once, and requires the exertion of but little strength. After the thread is cut the dies are opened and the plate lifted off. The thread is left in proper condition without taking time to turn the plate back. A bolt can be readily cut with this die plate so the nut will go on either tight or loose.

The dies are opened and closed with two sets of cams. The cams close the dies and hold them while the thread is being cut, and have a bearing the full size of the dies. The dies are all alike, and if any should get worn out or damaged, they can be duplicated by sending to the manufacturer.



BARNES' OPEN DIE PLATE.

The operation of changing the dies is as follows:

First turn the screw *G*, so as to bring the flat side of the screw in line with the lever *F*, then lift the cam-plate with the lever. Take the dies out and put in another set—the dies are all numbered, so there is no danger of getting them wrong; leave the dies away from the outside of the plate a little, put the cam-plate in, pressing it down until it rests on the dies, then push the dies back until they bear against the outside cams, then the cam-plate will drop into place. Turn the lever a little to the left, so as to turn the screw, bringing the round part of the screw-head to the lever, which will prevent the cam-plate from coming out. The dies can be quickly changed from one size to another.

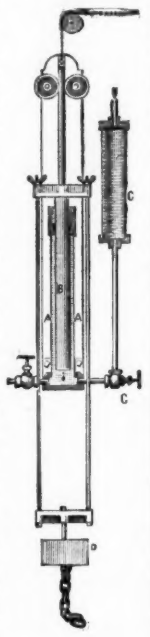
The small cuts show the plate in sections. *A*, the Dies; *B* and *C*, the cams; *D* and *E*, are slots or grooves for the cams. Part of the plate is cut away, to show the bearing that the cams have on the dies when they are cutting. The outside of the cams have a full bearing on the plate, making it strong and durable.

In cutting a bolt the lever is turned to the left until the index marks are in line and the plate placed squarely on the bolt. The plate is turned steadily forward until the desired length is cut, when the lever is turned to the right, the dies opened and the plate removed.

This die plate is being placed upon the market by H. Prentiss & Co., 14 Dey street, New York.

Improved Damper Regulator.

We lately examined a peculiar damper regulator attached to a pair of boilers. We were impressed with its simplicity and efficient operation, so now we publish an illustrated description of this novel device.



The apparatus consists of a tube or cylinder *AA* (see engraving), which is provided with a stuffing-box of the usual construction, through which a piston *B*, is made to move freely. A cross-bar is attached to the top end of the piston, to which is attached two long rods, which, passing down opposite sides of the cylinder, are secured to the ends of another cross-bar. The latter cross-bar supports a rod and weight *D*, which is constructed so that the weight may be varied. The valve *C*, communicates with the steam pipe or boiler. The chamber *G*, is for the purpose of furnishing additional surface for condensation, so that there is no possibility of steam entering the cylinder *AA*, which would destroy the packing in the stuffing-box. A small rod extends above the piston, from which a chain leads to a grooved arc upon the damper shaft in the chimney. The operation of the regulator is as follows:

The valve *C*, is opened and the water passes into the cylinder *AA*, and pushes up the piston *B*. If there be a sufficient weight at *D*, to balance the pressure, the damper will not move, but as the pressure rises the piston *B*, will be raised and the damper closed. The damper may be made to close at any desired pressure by increasing or diminishing the weight *D*, to balance that pressure.

This device requires very little room, and is so constructed that there is little danger of its getting out of order, and all parts are easily accessible. It moves very freely, and is sensitive to the slightest change in the boiler pressure.

By its use a nearly steady pressure of steam may be maintained. The apparatus is made by the Hallock Damper Regulating Co., Wallabout Mills, foot of Taylor street, Brooklyn, N. Y.

The preliminary survey of the Catskill Mountain Railroad from Catskill to Palenville, N. Y., was completed on Friday, the surveying party arriving at Palenville on that day. The grade from Catskill to Palenville has been found easy and cheap for construction. The road will be fifteen miles in length, and with such easy grades that the run can be made in from twenty to thirty minutes.—*Catskill Recorder.*

There is but one small machine shop now in Catskill, but this railroad will be likely to necessitate a new shop in that village. The road is wholly for summer travel.

The ragpickers of Cincinnati have formed a trade union for mutual protection.

Making Files by Hand.

The process of making files by hand-cutting, though carried on from the time files were first used, is imperfectly understood by the great body of mechanics, in its present improved state.

We have recently given some special attention to the subject, and will endeavor to describe the process as carried on in what we believe to be the largest factory producing exclusively hand-cut files in this country.

When purchased, the steel is taken to the store room, which contains twenty-five tons and upwards. From the store room it is taken to the forging shop, where it is cut to the required lengths for forging. Each length is then piled away by itself.

For heating, a plain covered brick forge, for hard coal, is used. The steel is heated and drawn out under a power-hammer, the "tang" being formed first, after which the other end is heated and drawn to the proper taper.

Special dies are fitted to the hammer and adapted to each class of work, so that only one heat is required on any file to form either end.

The operation of forging files may appear to some to be a rough process, but this is a mistake.

Forging file blanks properly is very particular work, as they must be of a uniform length, taper, and thickness. The dies in coming together produce a uniform size and shape every stroke, after which a few blows with a hand hammer are sufficient to complete the operation.

Flat, half-round, and square files are mainly forged under a power-hammer, but round files, also the smaller classes, are forged by hand. The anvil or forging block differs somewhat from those used for general forging, as will be seen by the engraving, Fig. 1. It consists of a block of stone *a*, set firmly in the ground. On this stone is placed an iron block *b*, which is firmly secured by wooden wedges in a deep recess. The plain face *c*, is for forging flat and tapered forms. The hollow swage block *d*, is for round and half-round shapes, while the hardy *e*, having a gauge *f* attached, is for cutting the forged shapes to a uniform length.

The block *b*, is arranged with slots, so that different swage blocks may be readily introduced. The hammers used in the file manufacture are of peculiar shape, as may be seen in Fig. 4, where *a* represents the style of hammer used for forging files. These hammers usually weigh about 5 lbs., and the reason for their peculiar shape is that in forging or cutting files a perpendicular blow is never required; but, on the contrary, an inclined blow is given, which has a tendency to draw towards the operator. The style of hammer shown has been found in practice to be the best adapted to the work, besides being the easiest and most convenient to handle.

For forging the "tangs" of small files a special furnace is generally used, and a hammer weighing about 3½ lbs.

After forging the blanks are stacked in the annealing furnace, by being closely piled upon fire bricks placed upon iron bars, forming a shelf across the furnace above the fire.

A slow fire is then started, and allowed to increase gradually the first day, while the second the heat is greatly increased, and the high temperature maintained for about 2½ hours, when the furnace is sealed up for one hour, and the fire is allowed to burn down.

At the expiration of the hour the fire is hauled, the furnace is again closed, and allowed to remain until the blanks are cool enough to handle. The whole time consumed is about four days. A natural draught is used for the annealing furnace, and the fire circulates all about the stack of blanks, thus subjecting all sides to a uniform heat. The fuel used for annealing is coke.

After annealing the blanks are taken to the grinding room. The grinding process is one of the most particular operations in the details of file manufacture, for if a

small portion of scale be left upon the surface of the blank, when the file is finished, a soft spot will indicate the position of the scale.

In grinding a number of a certain class, the files are placed in a holder and ground to a gauge, thus shortening the process and insuring more uniformity. The stones used are 5½ feet to 6 feet in diameter, having a 10-inch face. The speed is about 200 revolutions per minute.

Round blanks are held upon the stone by means of an iron hook attached to the end of a board, upon which the operator sits, his weight giving the required pressure upon the stone, while he guides the rapidly-revolving blank so as to be made round and of a proper taper from end to end.

A smooth and true surface upon the blanks is indispensable. After grinding, the blanks are taken to the stock room, where they are stored and taken out by the cutters, as required, and when cut are returned to the same room. In this way an account of the work of each individual may be readily obtained. The edges of common flat files are cut by passing through an edging machine. The edges of tapered saw files are also cut in the same manner. The machine is made to closely imitate hand-cutting. It is necessary to cut the edges of flat and saw files, also to cut the rounding side of half-round files before cutting the flat side. The block upon which files are cut is shown in Fig. 2. The block of stone *a*, is about eighteen inches square, which supports a block of iron *b*, which is held in a recess by wooden wedges. A groove *e*, passing through the center of the block *b*, has a lead lining upon the bottom, upon which the file is placed for cutting. The file is held by means of a leather strap *cc*, which passes over the ends of the file down through the edge of the stone, and around the foot of the operator at *d*, who sits upon a bench with the end resting against the front of the block *a*.

In cutting the end of a blank the tang is stuck in a handle, and only one part of the strap towards the operator is placed over the top, while the handle rests against the breast of the operator. Files are designated under three heads, viz.: single-cut, double-cut, and rasp, each of which are sub-divided into different degrees or classes, as rough, coarse, bastard, second cut, smooth, and dead smooth, which refers to the character of the teeth. Single cut files are those which are cut with the teeth all running one way and unbroken. The single cut is used for the coarser grades of files, the teeth being made by a single course of chisel cuts across the face, at angles varying from 5° to 15°, having a horizontal obliquity to the center line, according to the requirements. Second cut files are those which have two courses of chisel cuts at different angles, which cover the face of the blank with diamond-shaped teeth.

The first course is given a horizontal obliquity to the center line of 35° to 55°. This is called the *upper* or *over cut*, as it is cut lighter, after which the blanks are draw-filed, which process is called stripping, in order to give a perfectly smooth and even surface. The next step is to cut the second course of teeth—called the *under* or *up cut*—which are placed at angle of 5° to 15° horizontal obliquity to the center line. The teeth thus formed, when examined with a magnifying glass, have the appearance of the cutting edges of diamond-pointed lathe tools.

For cutting the coarser grades and rasp blanks the hammer shown at *b*, Fig. 4, weighs about 8 lbs., while those for ordinary work weigh about 5 lbs., and the chisel shown at *d*, is held at an angle of 75° to 80°. These chisels are made of the very best steel of the shape shown. The edge is first ground, then finely finished upon an oil stone. It must be perfectly straight and free from any roughness. The common work of cutting such coarse and half round files is done by apprentices.

Our readers will perhaps ask the question: How do file cutters get the teeth so even? It is done by feeling; the chisel is moved up until it touches the last cut made, when it is adjusted the proper distance, then a blow is given with the hammer. Some of the best cutters will set a newspaper up in front of them, and read while they work, not even looking at the chisel, as they work by the sense of *touch*. The rounding side of half round, round also, the upper cut of the smaller files, and stubbs, shapes, are cut by girls. The block used is shown in Fig. 3. It consists of a cast iron column *a*, which sets into a wooden bench *b*. The blank is held upon the head *d*, by the strap *c*, in the same manner as the larger blanks. The chisel, also hammer used, which weighs about 2 ozs., are of the same style as the former, only lighter, as shown at *e* and *c*, Fig. 4.

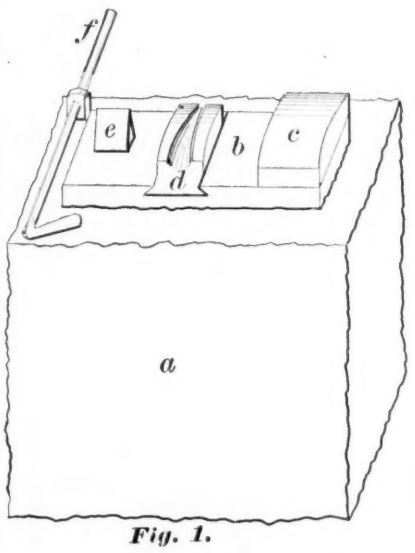


Fig. 1.

After being ground, the mall blanks are taken to a polishing machine, where they are given a smooth and polished surface.

After being cut, the files are ready for tempering. The heating is done by placing a number in a cast iron pot filled with melted lead, which is kept red hot and covered with the dust from a blacksmith's forge. The "tangs" are above the hot lead, and being protected by the flux upon the top, are not liable to receive a temper

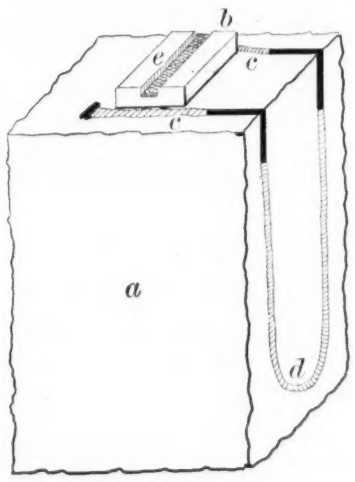


Fig. 2.

crack, which would otherwise be the case. This is a very essential point in file making.

Before being immersed in the pot, the files are straightened and covered with a paste made of salt, charcoal and burnt leather, which is to prevent the lead or other dirt from sticking in the teeth. After the paste is applied the files are dried thoroughly before being immersed in the pot of lead.

When the files have received the proper heat they are withdrawn from the pot and immersed in cool salt water, which contains all the salt that it will hold in solution, the specific gravity being about 100. If heated too hot, files will warp one way, and if not hot enough, will warp the other. This water is contained in a wooden tank, the low temperature of which is maintained by pumping it through a coil of pipe in a raceway running under the building, thence back to the tank, keeping up a constant circulation. The longer this water has been in use the better it performs its work. The files are withdrawn from the salt water while they are quite warm, and straightened, as they will invariably warp in tempering. This is an interesting operation.

The point of the file to be straightened is placed under an iron bracket with the hollow side upwards, the middle resting upon a support. The body of the file is then grasped with a forked lever, a gentle pressure is then applied and, at the same, time water is dashed upon the bottom side. The file yields very readily to this treatment and is thus straightened. This operation has to be quickly performed, particularly upon small files.

The next process is to place the files a few moments in a solution of oxalic acid, which removes the paste and loosens the dirt, after

Fig. 3.

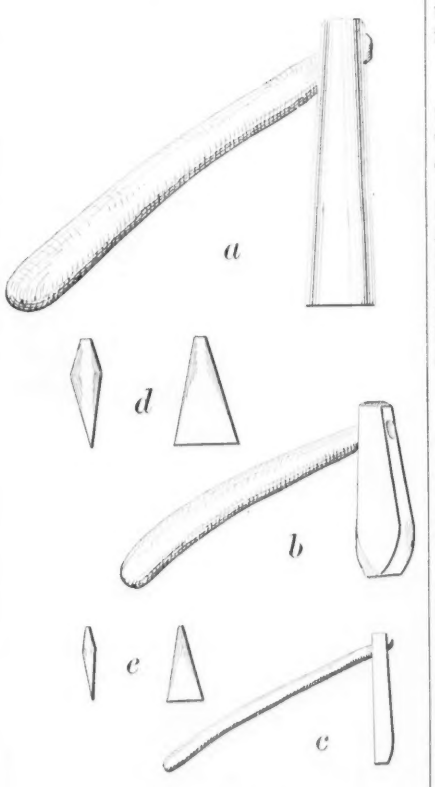


Fig. 4.

which they are scoured with a brush and fine sand. They are then rinsed out in clean water to remove any traces of the acid, and finally put into thick lime water where they remain over night. This prevents them from rusting. In the morning they are taken out and carefully dried by artificial heat. Each file is then examined by an inspector who rubs a piece of untempered steel over the surface, and if there be any soft places they may be very readily detected; in which case they are rejected. After inspection they are brushed over with oil, which takes out the lime that remains, when they are "rung" upon an anvil, which will cause them to break if there are any temper cracks in them. The files are now put into packages, and are ready for the market; and we will say a word about the admirable way adopted for packing, which is by placing them in heavy paper boxes, with the name and size of each class printed in plain letters and colors upon the ends and sides of each particular package.

The different sizes of files may be identified by the colors of the letters upon each package, as well as the words and figures. The packages having square corners may be packed in less space.

The manufactory from which we derived the foregoing information is that of Kearney & Foot, Paterson, N. J.

The following American exhibits, intended for the Melbourne Exhibition, were lost by the wreck of the ship, *Erie, the Red*, and cannot be replaced, as it is too late:—The Russell and Erwin Manufacturing Company, general hardware and bronze articles; the Eagle Lock Company, locks; Colt's Manufacturing Company, firearms and a Baxter engine; Edward Miller & Co., plated ware; Ives & Miller, hardware; the United States Stamping Company, stamped metal articles; the Connecticut Board of Managers, a large show-case built expressly for displaying the exhibits from Connecticut; F. S. Pease, of Buffalo, lubricating and illuminating oils; the estate of Samuel S. White, of Philadelphia, dental supplies; Stewart Hartshorn, window-shade rollers; the Washburn and Moen Manufacturing Company, wire.

M. Dumas finds that not only iron and silver possess the property of retaining large amounts of gas for an indefinite period, but that aluminum and magnesium also have the same property. For equal weights magnesium contains a volume twice as great as aluminum; but magnesium is so much lighter than aluminum that it will hold only one and a half times its own volume. Silver seems to prefer oxygen; aluminum and magnesium hydrogen; each metal appearing to have its individual preference.

A mechanical engineering friend writes us from California that his mining researches there have taught him several new wrinkles, one of which we quote:

"Gold mining is not the easiest job I have had yet. Gravel in the East and gravel in California are two very different things. Here fine gravel is stones from one to five pounds weight, and coarse gravel is anything less than the weight of a barrel of flour! In my boyhood, I was taught to call these rocks and boulders, but one learns a good deal as one gets older."

The advocates of "free ships" in this country, who fancy that the supremacy of wooden vessels can be restored by that or any other policy, may find foodfor thought in the following item from the leading British hardware journal, the *Ironmonger:*

NEW GLASGOW, N. S.—A short ride by rail from South Pictou brings the traveler to New Glasgow, which resembles old Glasgow in being overhung with smoke. There are iron foundries, tanneries, a pottery, and shipbuilding yards. The largest Nova Scotian ships are built here, but only one ship is now on the stocks. Indeed, half of the complaints as to trade in this province are due to the cessation of a demand for wooden vessels. If a vigorous attempt were made to establish iron shipbuilding, it is quite possible that the iron vessels of New Glasgow might become serious rivals to the iron vessels of the Clyde.

A National Exhibition is to take place at Moscow, Russia, next year. The Government has decided upon a display of iron ore and metal from every part of the empire, and a circular has been issued to all the provincial governors, instructing them to have forwarded as many specimens as possible, as a commission will be appointed to report upon their quality, and compare them with ores and metals from Scotland, England, Germany and other countries. This measure is only one of many having for their object the restoration of the Russian iron trade, now completely crushed by the metal imported from abroad. Formerly, Russia largely exported iron to England, from which country she received no metal whatever except in a manufactured form. To-day she imports yearly 3,000,000 poods, or 50,000 tons, of pig iron alone, much of it arriving from Scotland, and exports only a few hundred tons to foreign countries. Last year the imports of metal and machinery amounted to the value of £20,000,000 sterling. This high figure has not escaped the attention of the Government, and it may be confidently predicted that something will be done to check the influx of Scotch and English metal.—*Ex.*

Advantages of High-Speed Engines.

BY CHARLES T. PORTER.

No. 15.

Undoubtedly, high speed in any machinery, and preeminently in steam engines, demands the nearest attainable approach to mechanical perfection, first in design, and second in construction and workmanship. This approximation, sufficiently near for practical requirements, is quite possible, and when it is attained all difficulties of operation at high speed vanish together. The reason is, that high speed is simply the revealer of defects and of our ignorance. It often happens, not only in attempting high speed, but in anything mechanical, that we do as well as we know, and on practical trial of our work, find that we did not know much. Then comes our chance to learn.

A wheel or pulley affords a simple and excellent illustration of high-speed requirements.

If this is to rotate slowly, it makes but little difference how it is made, nor what strains from unequal contraction it contains, nor how much it is out of balance. If, on the other hand, it is to revolve swiftly, then these things must be attended to, and the more swiftly it is to be run, the more carefully they must be looked after. When the requirements in these respects are all understood and completely met, then the wheel runs without the least jar or vibration at any speed.

But, undoubtedly, the art of designing and constructing wheels for great speed, insuring freedom from internal strains, determining the limit of speed that the size and the tensile strength of the material render safe, and truly balancing, especially when the different sections must be balanced, each in its own plane of revolution, can only be safely exercised by those who, by study and experience, have made themselves masters of it.

Now, it is obvious, on a moment's reflection, that there cannot, in the nature of things, be any other standard of mechanical work except perfection. Truth does not admit of degrees.

The degrees of error, on the other hand, are infinite. Where on the scale of imperfection shall a standard be placed?

We apply this standard of perfection continually; no conscientious workman would dream of employing any other. But we can only rise to our own ideal of perfection, and often this is very low, indeed. Comparatively few workmen in this country have, for instance, any higher idea of a plane surface than that which can be produced by a planer. Now, there are all sorts of planers, both tools and workmen, and they can produce all sorts of surfaces, except true planes.

I was, a number of years ago, endeavoring to produce an original surface plate, and, the three plates having been carefully planed, the most skillful workman I had was scraping them up under my own direction, when my then foreman, to whom the whole thing seemed a mere waste of time, observing how imperfect the contact was when the plates were rubbed together, remarked: "It's my opinion you'll never make a job of that till you put it on the planer, and take a light cut over it."

In some particulars, again, every mechanic's ideal of mechanical truth is correct. He knows, for example, that the only place for a piston rod is absolutely in the center of the piston; that the only position for a crank shaft is absolutely at right angles with the axis of the cylinder, and for the crank pin absolutely in line with the shaft.

These three examples from a steam engine are selected as illustrations of another diversity. The truth of a piston rod in a piston is attained in practice by every good lathe hand, as a matter of course. The squaring of a shaft with the center line of an engine requires a higher degree of skill, but a competent erecter has his tests by which he determines this position with entire precision. But the lining of the crank pin with the shaft is so nice a matter that very few are set absolutely true, and very few mechanics can determine with certainty whether one is true or not. But all alike mean to set them true, employ all the means they know of to attain truth, and suppose they have done so.

Immense improvements have been made of late years in truth of construction. Mr. Sickles, the inventor of "the trip cut-off," since known under the more euphonious title of "the liberating valve gear," told me twenty years ago that he had occasion, in a machine he had designed, to run a spindle, under some pressure, at 7,000 turns a minute, and for a long time it seemed impossible to prevent it from heating. After awhile he satisfied himself that the whole trouble was, that the spindle was not round. He had taken great pains to make it round, and supposed he had done so. In fact, said he, it was very nearly round, but it was not round. He contrived a grinding apparatus that finished his spindle round, and the tendency to heat disappeared entirely.

At the present day this is not considered anything remarkable, but in many machines such a speed is attained as a matter of course.

So, in steam engines, the change in the views of engineers as to the practicability of high speed has, since Mr. Sickles related to me the above incident, been surprising, amounting to a complete reversal of judgment. We all smile now at what were then regarded as very serious objections.

When the jury at the exhibition in London, in 1862, (and by the way it is curious that the English have not held another since then, and don't seem ever likely to) were examining the little engine I showed there, 8 inches diameter of cylinder by 24 inches stroke, running at the then unheard of speed of 150 revolutions per minute, they became lost in a grave discussion of the question whether the piston would not get away from the steam; until Professor Rankine, who had not before spoken, cut it short with the authoritative remark: "There is no limit to the speed at which steam will follow a piston." Now engineers have very generally reached Professor Rankine's standpoint.

It is by no means likely that the practically useful limit to the speed of engines has in any case been attained. The road is open, the goal is attractive. I will close these articles with a piece of gratuitous advice, which will not be much needed, to every one who proposes to *practice* high speed engineering, first to *study* it.

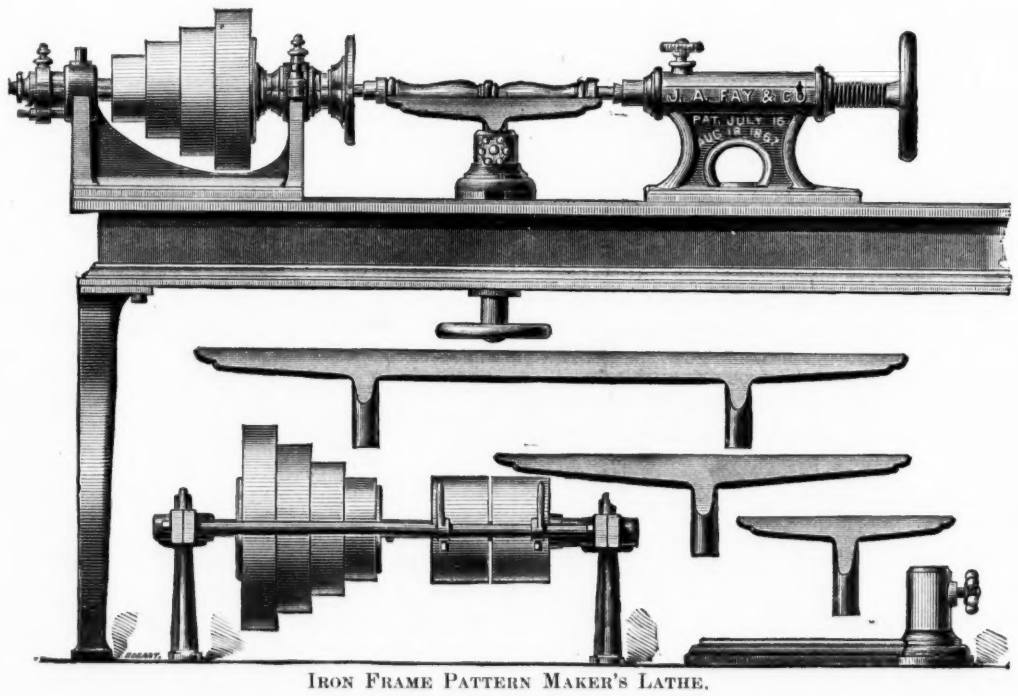
The New York Central & Hudson River Railroad Company has given an order for 15,000 tons of rails from the Cammel Works of Sheffield. The terms of the contract are not stated.

Iron Frame Pattern Maker's Lathe.

The pattern maker's lathe represented by the engraving on this page, is made entirely of metal, and complete in all its parts, having shears, head and tail stocks, with bolts and convenient screws for fastening to the shears, rests, and sockets. These lathes are fitted to the shears upon planed ways, which retain the centers exactly in line in any position the head and tail stocks may be placed.

When desired, the head stock is fitted up with an extra screw, on the back end of the spindle, made to fit a face-plate with a left-hand screw. Being clear of the end of the shears, large circles can be turned, a separate screw being provided to receive a rest, which can be adjusted to accommodate the size of circle being turned. To receive the back thrust of the stuff being turned, there is a take-up at the back end of the head stock, fitted with a screw of gun metal for relieving the collars of the spindles of all friction. This can be quickly removed when the face-plate is used for turning large diameters.

This lathe is one of the productions of the well-known house of J. A. Fay & Co., Cincinnati, Ohio.



Iron Frame Pattern Maker's Lathe.

The *Inter-Ocean* says that several emissaries of the London Cobden Club are in Chicago disseminating British Free Trade ideas throughout the Northwest.

It is evident from the statement which President Diaz makes in his annual message that the Mexican Republic has awakened thoroughly to the importance of connecting the chief towns by railroads. He says that he has given ten States authority to build railroads, and he speaks of ten lines which are being constructed. These include the Inter-oceanic Railroad at Tehuantepec, the line from Guaymas to our frontier, and the two great trunk railroads which are to establish communication between the Mexican Capital and the American system, with two branches to the Pacific. Such evidences of progress are significant in a country which a few years ago could boast only of the English built line from Vera Cruz to the Capital.—*New York Tribune.*

The largest locomotive in the world was one built in France in the year 1857, an enormous express engine, on six wheels, with two pair of coupled driving-wheels ten feet in diameter. The point most worthy of notice in this engine is the manner in which driving-wheels of this diameter are applied, the difficulty in wheels of this size of keeping the center of gravity sufficiently low, having always been a stumbling block to English engineers. This object is attained by separating the boiler into parts, placed vertically, one above the other, the lower part forming the water-chest, and the upper part the steam-chest connected by large vertical tubes. The axles of the driving-wheels pass between the water and steam-chests in the aperture between the vertical tubes.

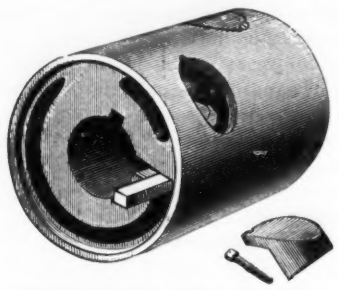
The next largest in size are the English locomotives, one being the Cornwall on the London and Northwestern R. R., with driving-wheels 8 feet 6 inches diameter single wheel, and one on the Great Western Broad Gauge named the Flying Dutchman with wheels eight feet diameter.

It is said that pencil drawings may be rendered ineffaceable by this simple process: Slightly warm a sheet of ordinary drawing paper; then place it carefully on the surface of a solution of white resin in alcohol, leaving it there long enough to become thoroughly moistened. Afterward dry it in a current of air. Paper prepared in this way has a very smooth surface. In order to fix the drawing, the paper is to be warmed for a few minutes. This method may prove useful for the preservation of plans or designs, when the want of time or any other cause will not allow of the draughtsman reproducing them in ink. A simpler plan than the above, however, is to brush over the back of the paper containing the charcoal or pencil sketch a weak solution of white shellac in alcohol.

By means of an ingenious clock-work apparatus, Marey, the French biologist, has obtained a number of exceedingly interesting graphic illustraions of the manner in which man walks. The instrument is a vertical barrel, covered with finely ruled paper, and as the barrel is made to revolve by the gearing within it, a little pencil makes a mark on the paper, as the person whose walk is under investigation steps along with the registering device. A little air-compresser, worked by the foot of the walker at each step, sends a current of air through a flexible pipe to the instrument, and gives a more or less up-and-down movement to the pencil. It has been found that the step in going up hill is longer than in going down hill; that the step is longer for an unburdened man than for a burdened one, and that the step is longer when the sole of the boot is thick and prolonged beyond the toe, than when it is short and flexible. When a person ascends a hill he quickens his pace, but diminishes its length, and he does just exactly the opposite when descending an inclination on the ground. It would seem that Marey's observations point to the advisability of pedestrians in general adopting low-heeled boots, with thick projecting soles.—*Sunday Times.*

Articles of incorporation have been filed in Colorado, of the Denver, Salt Lake & Western R. R. Co. The incorporators include Hon. Wm. A. Hamill, Edward O. Wolcott, Charles F. Hendrie and John Milner. The route to be followed by the company for their proposed road is to begin at Denver, and run to the Cache La Poudre by the most feasible route, at or near Ft. Collins; then proceed up the valley and through the narrows and cañons of the Cache La Poudre, following the main stream to the forks, thence via the south fork of said river to its head waters; thence by the most feasible route westward to the Bear or Yampa River; thence down the valley and through the several cañons of Bear River, with the privilege to extend the road to and into the Territory of Utah; together with branch lines from the main line, starting from the most feasible point and extending into the counties of Boulder, Jefferson, Gilpin and Clear Creek. The organization of the company is perfected on a capital of $500,000.

The Albany & Susquehanna Railroad has about completed the work of laying side tracks along its line. Over thirty miles of branches have been laid within the space of a month.



Walker's New Shaft Coupling.

There are few things about a machine shop which will cause as much dissatisfaction, loss of time and expense, as a loose coupling.

When a coupling of the ordinary style gets loose, it is a very difficult matter to make it tight; consequently, the machinery has to be run at a reduced speed, until a convenient time arrives in which to remedy the difficulty. It always pays to have shafting and couplings that can be relied upon. We illustrate herewith Walker's new coupling, which is made by the Nordyke & Marmon Co., of Indianapolis, Ind.

This coupling possesses extraordinary clamping power, yet may be easily and quickly tightened or loosened. The principal feature is the manner in which it clamps each end of the shaft. By the internal arrangement, the ends of each shaft are clamped separately. The coupling proper is in one piece, but consists essentially of three parts, viz., an outer continuous shell, and two clamps projecting from the inside of the same. The clamps are drawn tight around the shafts by studs, which pass loosely through the fixed portions of the clamps, and are fastened into the free ends of the same. The tightening is done by nuts and ball washers, in the recesses provided for them. The nuts are provided with caps, which form a continuous surface with the shell, upon which a circle is divided into twelve parts, so that the nuts may be locked in any of the twelve positions.

With these precautions there is little danger of the coupling getting loose. Two lengths of shafting of different diameters may be united by means of this coupling.

The reader will observe that with this coupling little power is lost by friction in tightening it upon the shaft. The spring part of the coupling is so constructed that it binds equally upon the entire circumference of the shafts. In turning the nuts, the force exerted upon the wrench is lengthwise of the shaft, thus obviating any tendency to turn the shaft while tightening.

The small caps represented in the engraving are for covering the holes, so that there are no projections upon or holes in the couplings to catch belts or clothing.

To loosen one of these couplings upon a shaft, all that is necessary is to remove the lock pieces, slacken the nuts, open the spring clamps by driving a wedge in at each end, on projections for that purpose. To tighten it, see that the ends of the shafts meet in the center of the separation of sleeves, remove the wedges, screw up the nuts as tightly as possible, with the wrench provided for that purpose, and replace the lock pieces.

We learn that matters are progressing favorably in the machine shop of the Cornell University, Ithaca, N. Y., and that much "solid work" is secured from the students. They are building, among other things, a 3x5 inch vertical engine, after Clinton's design.

The newspapers of Peoria, Ill., are advocating the building in that city of a first-class mill for the manufacture of book and news paper. They estimate that it will cost $60,000 to build and $60,000 to operate such a mill.

Preparations are being made towards building a large pulp mill, for Boston parties, at Snow Falls, Paris, Me. The contract has been awarded.

A New Power Hammer.

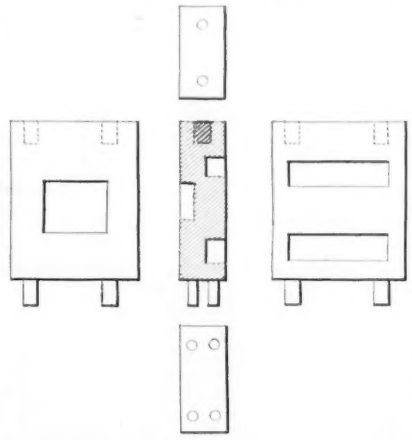
The new power hammer, illustrated upon this page, is constructed so that the downward stroke is one-sixth quicker than the upward stroke. This feature is calculated to lessen the power required to perform the up stroke, and increase the effectiveness of the down stroke.

The semi-elliptic springs, shown on top and bottom of the beam, serve to balance the stroke, so that the hammer may run from 350 to 450 strokes per minute, with safety to the machinery. The hammer is adapted to almost any form or kind of forging. Large dies may be inserted for various forming and welding, such as making plow shares and other articles, which require that the operation be commenced with a light tap, and increased to a heavy blow at the will of the operator. It is claimed that the hammer is always under perfect control of the operator, to start and stop, and to increase or diminish its power. With a slight pressure of the foot, the stroke may be increased from the lightest to the heaviest desired.

It is claimed that the hammer is free from any side motion, always striking unerringly in one place. Thus, shears and dies combined, may be used for cutting and forming small staples, and all work of this class which can be done with one stroke of either cold or hot iron.

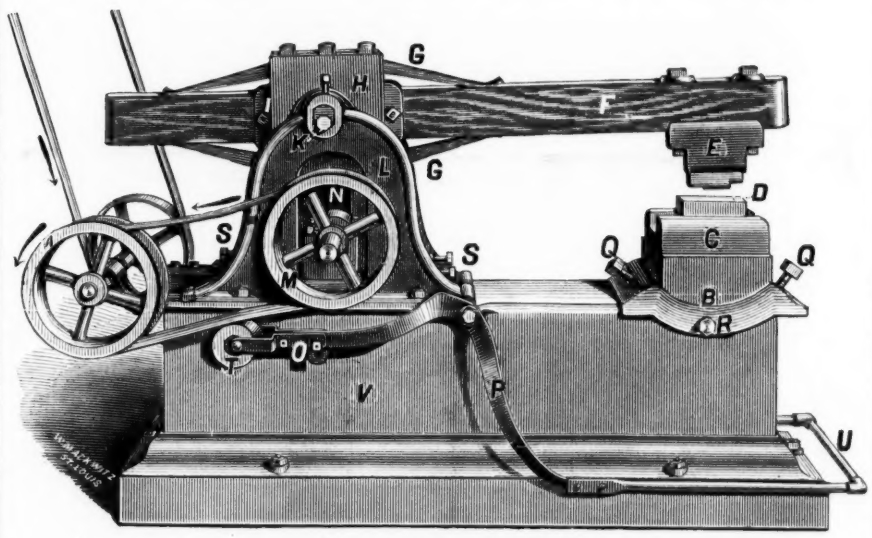
The whole structure is mounted on a substantial iron bed V, 18 inches deep, 22 inches wide and 5½ feet long. Attached to this bed V, are two circular arms L; between them is pivoted near their top, at K, an oscillating frame H, having an opening longitudinal, in which is attached two semi elliptic springs GG, and two plates I, with trunions projecting laterally through the oscillating frame at K; the hammer beam F, is inserted between the springs GG, and the trunion plates I, which are bolted firmly to beam F at I; the ends of the trunions and outsides of the oscillating frame H, rest evenly against the inside of the circular arms L; at K a shaft is passing through the trunions and beam F, and made ridged in them with its ends resting in boxing at K. Caps are provided to cover the ends of the boxing and shaft with set screws projecting against the ends of the shaft, which secures it against end play.

By these mechanical arrangements the beam F and oscillator H are securely attached independently, vibrating on one common center, allowing no side play of the hammer E, admitting F to the free action of the springs GG; in the lower end of the oscillating frame at N is a lateral opening 10 inches vertical by 6 inches longitudinal and 4 inches laterally, with flanges projecting longitudinally one inch into this opening from both sides. This makes the opening two inches smaller on the outside than the internal cavity; the rear and front internal walls are provided with steel plates, 4x10 inches, ¼ thick, resting against the inner ends of four set screws not shown, provided to adjust these plates to or from the sliding box at N, to compensate for wear and prevent lost motion. These plates and flanges from slides and guides between which a loose box and eccentric is provided with shaft projecting laterally through boxing at N, which project upwards from an adjustable frame immediately under the oscillator H; this permanently locates the eccentric and shaft in the lateral opening in the oscillator H, at N. The adjustable frame mentioned rests on suitable bearings on the inside of the circular arms L, and is fastened down by four bolts passing through



suitable slots in the adjustable frame, entering the bearings on the arms L. This frame is adjusted back or forth by set screws SS; this adjustment is for the purpose of giving a greater or less distance between the anvil and hammer at D, as may be desired for large or small work, long or short dies, etc.

The anvil B, weighing about 500 lbs, sits down in the bed at R and rests on circular bearings (between R and B), which radiate to the center of the top of the anvil at D,



NEW POWER HAMMER.

and is held rigidly in any position longitudinally desired by set screws QQ, with their inner ends resting on shoulders on the sides of the anvil B, which projects down about ten inches; between this lower projection and the internal wall of the bed is sufficient space to admit of any adjustment desired. This lateral adjustment is accomplished by set screws R, passing through the sides of the bed V, with their inner ends resting against the anvil which holds it rigid at any lateral adjustment. By this arrangement the anvil is accommodated to all and any class of work or shape of dies.

The anvil is constructed in two parts. Four inches of the top C, may be taken off, leaving a suitable place to insert large dies for various purposes, such as dies for welding plow-shares and dies for forging journals on large shafts. A counter shaft, provided with suitable pulleys, is attached on the rear end of the bed; this shaft is kept constantly in speed and power by the vertical belt in the direction indicated by the dart ←; the other end of the shaft is provided with a flanged pulley, corresponding to a flanged pulley M, on the eccentric shaft; around these pulleys is placed a loose belt ←; in contact with this belt is a press pulley T, adjustably attached by two arms to the projecting end of the treadle P, at O. If the foot be placed on the treadle at U, and it be pressed down, the break on the opposite side breaks contact with the balance wheel (not shown); the press pulley will at the same time tighten the loose belt on the flanged pulleys. This gives motion to the pulley M, in the direction indicated by the dart. Its motion is increased by a heavier pressure until it rolls off the same surface of the other flanged pulley; this would be the full speed, which may be diminished to any speed desired by lessening the pressure on the loose belt. By this means motion and power is given to the eccentric, which carrries back and forth the lower end of the oscillating frame H; this gives vertical motion to the springs GG, which imparts corresponding motion to the beam F. These springs accomplish a three-fold object:

First, They carry the hammer E up and down.

Second, They cushion the hammer at the returning points and give off that power which was stored in them while cushioning.

Third, By the power exerted in the machinery they follow up and impart still greater force to the blow.

It is found by this arrangement of eccentric loose box and oscillator that when the machinery is moved in the direction indicated ←, that the downward stroke is one-sixth quicker than the up stroke; this is a natural result, for the down stroke is performed while the eccentric is revolving above the center of its shaft and nearest the fulcrum of the operator H. With the present arrangement the downward stroke is performed with five-twelfths of the revolution and the up stroke is performed with seven-twelfths; the difference is two-twelfths, which equals one-sixth. The up stroke is performed while the eccentric is revolving below the center of its shaft and in that part farthest from the fulcrum of the oscillator H, so if the machinery was reversed the quick stroke would be up and the slow stroke would be down.

This new power hammer is the invention of C. W. Corr, Carlinville, Ill.

Letters from Practical Men.

MAKING DRAWINGS.

Editor American Machinist:

There seems to be a dispute in reference to a correct manner of showing the several views in mechanical draughting. My plan has been, to first make a sectional view, then throw a view of the top over the section or on top of it, a bottom view (when necessary) below, a right hand view on the right, and a left hand view on the left. Or in other words, taking the section as the starting point, I make a view of that side of the section which lies next the view I am working on. Maybe I can better show you by a sketch. I do not know if this is conventional or not; but I think it is better than making a drawing so full of dotted and broken lines, and I can see no objection to it. Of course, everything does not call for the five different views, but very often it is as important to have a view of the bottom of a piece of machinery as of the top. If (as in the case of nuts and bolts, where no section is usually given) there is no section necessary, I generally imagine a section to be there. But in all complicated work, in fact in all but the very simplest pieces, I invariably put in the section, and project directly from that. I am not, however, going to enter into debate with your more experienced correspondents, but give my views for what they are worth.

Respectfully,

Catasaqua, Pa. J. H. FRAUNCES.

LIGHTING SHOPS.

Editor American Machinist:

To light a shop or factory in a way that will combine the cheapness of kerosene with the convenience and safety of gas, mount a long three inch iron pipe horizontally, and tap holes in the top to fit ordinary lamp burners, placing them the required distance apart. If one end of the pipe has a short elbow, extending upwards, it may be easily filled without removing any burners. By using tin shades, as suggested by Mr. Dolbeer, there will be little loss from breakage. E. W. THOMPSON.

Cornell University, Ithaca, N. Y.

DIAMETERS OF GEARS.

Editor American Machinist:

I noticed an error in your issue of 16th inst. (No. 42), as to the diameter of a gear. Question asked by G. A., Cambridgeport: "If a gear with 18 teeth is .41 inch in diameter, what will be the diameter of a gear with 101 teeth?" It is understood the diameter of a gear to mean the whole diameter or diameter of gear blank, unless otherwise stated. Now, a gear with 18 teeth, .41 inch diameter, contains 20 diameter pitches, viz., 18 inside of pitch line, and 2 outside; and a gear of *X*, diameter 101 teeth, contains 103 diameter pitches, viz., 101 inside of pitch line; 2 outside. Now, in simple proportion, we have $20 : 103 :: .41 : X = 2.1115$ diameter of gear; not 2.30, as your answer gave.

Again, we have $\frac{41}{20} = .0205 =$ diameter pitch; or $\frac{1}{.0205} = 48.78044$ teeth for every inch *in diameter* inside of pitch line. Again, we have $.0205 \times 101 = 2.0705$ pitch diameter of large gear, $.0205 \times 18 = .369$ pitch diameter of small gear: $\frac{2.0705 + .369}{2} = 1.21975$ distance between centers; $\frac{101}{18} = 5.61111 +$ ratio of speeds.

Hoping this will meet with your approval.

Yours very truly,
G. H. S.

Providence, R. I.

Allen's Pneumatic Riveter.

In our issue of April, 1878, we presented engravings and a description of a new riveting machine which has since been so much improved that we take occasion this week to explain the essential features of the machine as now in use.

The riveter works on the principle of hand work, forming the head of the rivet by a succession of rapid blows around the rivet, until the desired shape of the head is obtained.

Fig. 2 represents the riveter detached from the shell.

It consists of two levers, having at one end a pressure cylinder to open and close the levers, and at the other end the riveting machine on one arm, and a suitable die with counter-weight attached on the other arm.

The long arms of the levers are made 63 and 73 inches from center of joint pin to the center of riveter, capable of reaching a rivet 60 or 70 inches, respectively, from the edge of the plate, so as to operate upon the circular seams of a boiler. The levers are supported in a turning ring operated by a worm-wheel, to enable the machine to be placed at any desired angle and position to the boiler shell.

The riveting machine proper consists of a cylinder, with the hammer head attached to the end of the piston rod, capable of being easily changed to adapt the machine for different sizes of rivets and heads.

The valve is operated directly by the pressure in the cylinder without extra gearing, and is so arranged that the length of the stroke regulates itself automatically, to correspond with the gradual reduction of the end of the rivet as the head is formed.

The machine is operated with an atmospheric pressure of from 20 to 30 pounds to the square inch, and makes from 150 to 200 strokes per minute. The time required to form the head of a ¾ inch rivet is about six seconds, and at steady, straight work, allowing for ordinary detention and loss of time, *two rivets* can readily be finished in *one minute*.

The machine may be suspended from a bar arranged overhead, to allow a longitudinal motion to the riveter when operating on straight seams, but in most cases a traveling carriage is used on the floor.

The operation with the machine is as follows:

The rivet boy, after inserting the hot rivet, moves the die and weight over the end head of the rivet, when the operator lets pressure into the cylinder *a*, by moving the rod *b*, thereby closing the long ends of the bars and bringing the end socket of the riveter upon the plates over the rivet, thereby holding the plates together by a pressure of about 1200 pounds. The operator then presses upon the spring valve *d*, thereby admitting the air pressure into the riveter to operate its hammer and thus forms the rivet head.

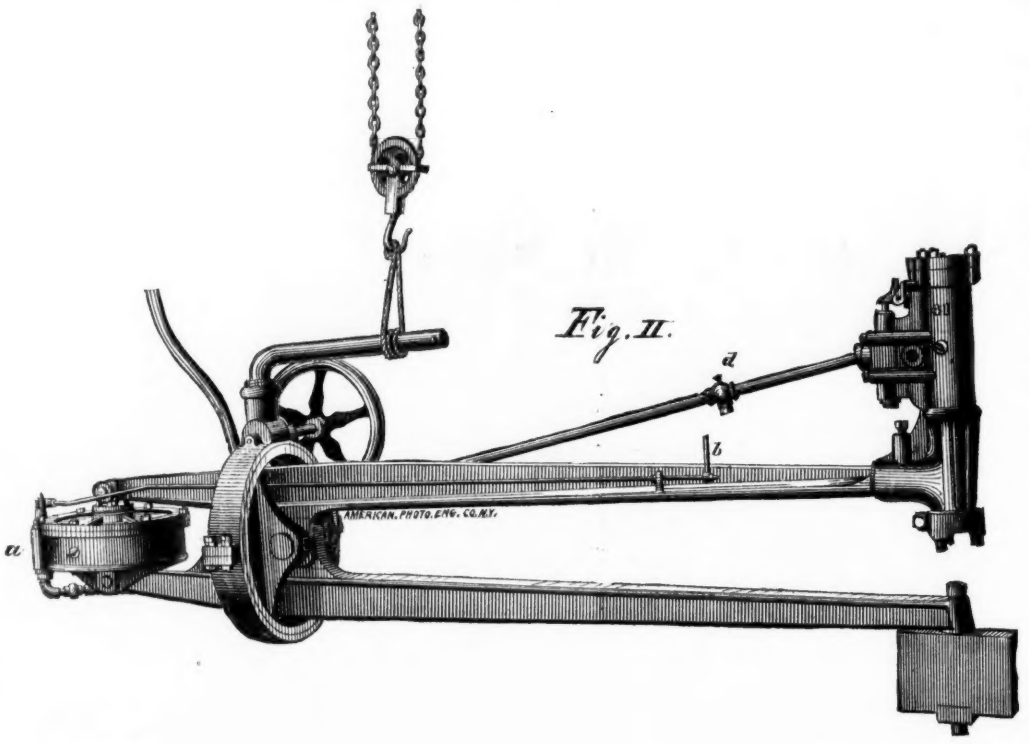


Fig. II.

It will thus be perceived that only one man is required to operate with this machine, dispensing with one riveter and the man to hold on.

The operation upon the rivets is not continued after the shape of the rivet head is quite formed, even if the end of the head should still appear hot. If it is desired to hammer the plates together—this can be done by fixing the machine tight upon the plates and hammering upon the plates, before the hot rivet is inserted.

By suspending the machine from a horizontal bar or traveling carriage, as shown in Fig. 5, it is easily moved from one rivet hole to the next when operating on a horizontal seam.

Figs. 3 and 4 represent Allen's Compression Riveter for Bridge work.

This riveter is principally intended for beams and girders for bridge building, and forms the rivet head by compressing the end of the rivet into a suitable die. The bars, turning on a fulcrum, contain at one end the dies, and are connected at the other end to a *toggle-joint*, to the center of which the piston-rod of a pressure cylinder is attached. The arms are made of *hammered steel*, and the arms *c*, and *d*, are made interchangeable, so that the machine with arm *c*, as represented in Fig. 3, will straddle the edge of girders or beams having six-inch angle irons on each side, and when arranged with the lever *d*, as represented in Fig. 4, plates may be riveted on to six inch channel iron.

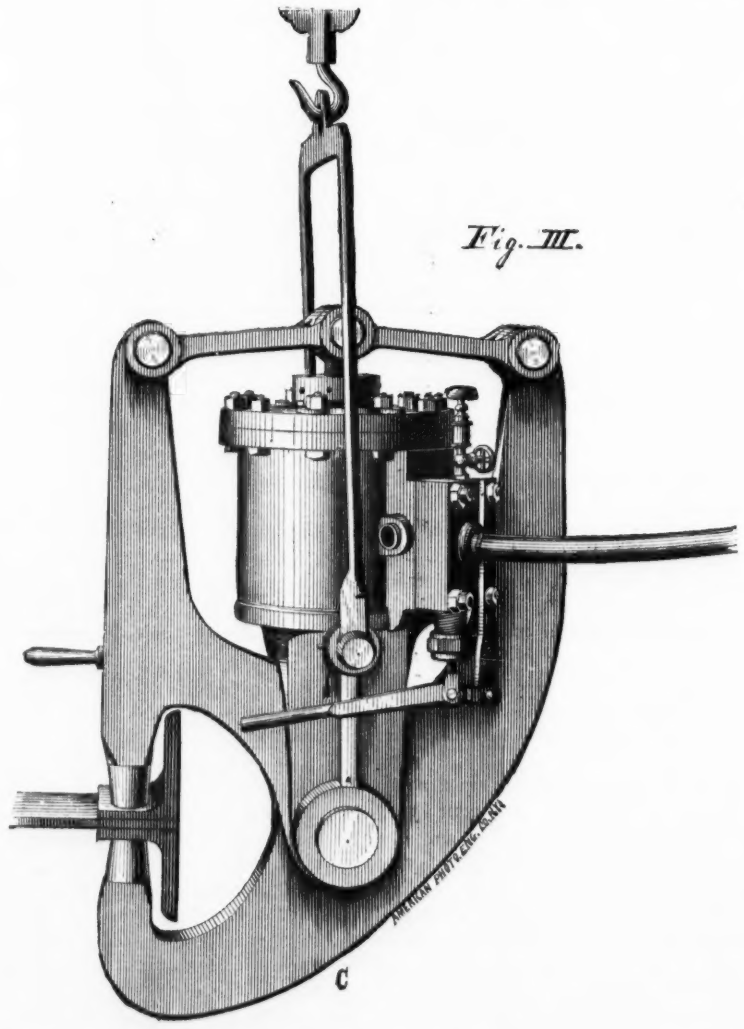


Fig. III.

The pressure used in this machine is from 50 to 60 pounds, and the arms are made of sufficient strength to operate on one-inch rivets. The weight of the machine complete is about 750 pounds. The same can be operated by steam or air, but for the convenience of handling the machine air pressure is to be preferred.

In consequence of the peculiar construction and arrangement of the elbow, or toggle joint, between the power employed for operating the machine, and the hinged or pivoted arms which carry the dies, a small ten-inch cylinder will produce, at the end of the stroke, or when the dies are nearly closed, a pressure upon the rivet of about fifty tons, or about one ton for every pound of pressure upon the cylinder piston.

Among the special advantages claimed for these riveting machines, we note: first, convenience, the machine being taken to the work, instead of carrying the work to the machine; rapidity of work; saving of labor, as but one man is required to do work, otherwise requiring three men; the machine requires no special foundation.

These riveting machines are manufactured by The Allen Portable Pneumatic Riveting Machine Co., 304 Broadway, New York.

Newly Incorporated New York Companies.

The Dieck's Pharmaceutical Extract Company, of New York: Capital stock, $20,000; par value of shares, $50. For the manufacture and sale of medical fluid extracts, elixirs, sirups, flavoring extracts and articles connected with them. Filed, Oct. 14th, 1880.

United States Piano and Organ Company, of New York: Capital stock, $10,000; par value of shares, $100. For the manufacture, purchase and sale of pianos and organs. Filed, Oct. 15th, 1880.

The American Champion Bicycle Manufacturing Company, of New York: Capital stock, $300,000; par value of shares, $10. For the manufacture of bicycles. Filed, Oct. 15th, 1880.

Wilford Publishing Company, of New York. Capital stock, $10,000; par value of shares, $100. To manufacture, print, publish, purchase and sell books, pamphlets, newspapers, pictures, engravings, charts, maps and other publications of similar character. Filed, Oct. 15th, 1880.

The Timby Ore Mill Company, of New York and Fitchburg, Mass.: Capital stock, $300,000; par value of shares, $25. To manufacture, buy and sell mills for crushing ore, and other machinery connected therewith. Filed, Oct. 16th, 1880.

New York Braided Wire Mattress Company, of New York: Capital stock, $10,000; par value of shares, $25. For the manufacture and sale of wire mattresses and other similar articles. Filed, Oct. 18th, 1880.

The Dighton Manufacturing Company, of New York: capital stock, $15,000; par value of shares, $100. For the manufacture and sale of mineral and other colors. Filed Oct. 18th, 1880.

Utica Paper Company, of Utica, N. Y.: capital stock, $15,000; par value of shares, $100. For the manufacture and sale of paper. Filed Oct. 19th, 1880.

The United States Compressed Gas Company, of New York: capital stock, $1,000,000; par value of shares, $25. For making, compressing and selling oil gas, and erecting manufactories for same. Filed Oct. 19th, 1880

The E. D. Clapp Wagon Company, Limited, of Auburn, N. Y.: capital, $200,000; par value of shares, $100. For the manufacture and sale of farm wagons and other vehicles, wagon and carriage wheels, and other material entering into the construction of the same. Filed Oct. 16th, 1880.

RAILROADS.

Ocean Beach and Sheepshead Bay Railway Company. Directors: William C. Nicoll, Isaac L. Egbert, F. A. Lovecraft,

William M. Hoes, Robert Center, R. C. Livingston, E. W. Vanderpool, W. Stannard Wood, E. O. Gould, C. E. Hoyt, Evardus H. Sly of New York, and Robert A. McKinney and Frederick Jansen of Brooklyn; capital $100,000; shares $100 each. To construct, maintain and operate a railroad, commencing in the town of Gravesend, Coney Island, where the lands of the N. Y. & M. B. R. R. Co. join the lands of William A. Engeman and others, and running by most direct and feasible route to inter-section of Avenue Y and Ocean Avenue in town of Gravesend. Filed Oct. 18, 1880.

Suburban Rapid Transit Company, of New York. Directors: S. R. Filley, B. G. Arnold, Gustav Schwab, John J. Crane, C. Kinney Smith, Charles W. King, H. H. Crocker, jr., Thomas S. Elliott, and Humphrey J. Monohan; capital, $600,000; par value of shares, $100. To construct, maintain and operate a steam railroad, extending from points in New York City to Westchester County, in routes known as Central, East Side, Fordham Avenue, and Eighth Avenue routes. Filed Oct. 19, 1880.

The Apprentice as a Citizen.

From an article by Prof. Silvanus P. Thompson, in the November number of the *Popular Science Monthly*, we make the following pointed extract:

The present state of British commerce brings home the conviction that it is no idle cry that has sounded ever and anon in our ears, warning us of the deterioration in the quality of our manufactures and in the average caliber of our skilled artisans. International exhibitions have, from time to time, afforded the means of drawing comparisons between the work of other nations and our own work; comparisons by no means always in our favor, often the reverse. Apprenticeship, with its wholesome rules, having decayed in everything but form, the lads who enter the shops are never properly instructed, but are made the drudges of the older workmen. What wonder that they acquire habits of idleness and carelessness that not only pursue them through the whole of their work, but, worse than this, corrupt and undermine their morals? What wonder that their manipulation is but half acquired, or that the methods and devices they learn to apply are those of half a century ago; ancient relics of prejudice and unscientific "rules of thumb," handed down by the tradition of the shops, a veritable survival of the unfittest? Without the shadow of a doubt, the truth that there is—and alas, that there is—much truth in the outcry concerning the inferiority of training and capacity of the British artisan, may be very largely imputed to the relaxation and degeneration of the old system of apprenticeship; for, with all its faults, it did at least provide that a skilled master should become personally responsible for the training of the apprentice in his craft. In that famous codicil to his will, wherein Benjamin Franklin devised so many thoughtful legacies to promote the well-being of the land and city of his adoption, he wrote—and we must remember how intimate and many-sided was his acquaintance with the condition of labor in his day—these ever-memorable words: "*I have considered that, among citizens, good apprentices are most likely to make good citizens.*" If this be true, seeing how rare a good apprentice is in the present day, the aphorism instilled into our ears as schoolboys, *Boni cives rari* (good citizens are scarce), threatens to receive a weighty comment from the experience of the nineteenth century! Be this as it may, a very little consideration will show how real is the crisis to be faced, and how irrevocably of the past the apprenticeship of the past is.

Composite Steel and Iron Plates.

The heavy iron and steel departments, South Yorkshire, both exhibit an improvement, and most of the mills in this district are now running full time. It appears that the armor-plate manufacturers have mastered the difficulty of turning out plates of composite steel and iron, and in consequence this branch is again busy after a comparative depression extending over the past four years. The local patentees of the composite plates are Mr. Wilson (Messrs. C. Cammel & Co.) and Mr. Ellis (John Brown & Co., Limited).—*Engineering.*

GAS DETECTION.—An ingenious instrument, termed a "spark tube," for indicating the presence of inflammable gases in mines,

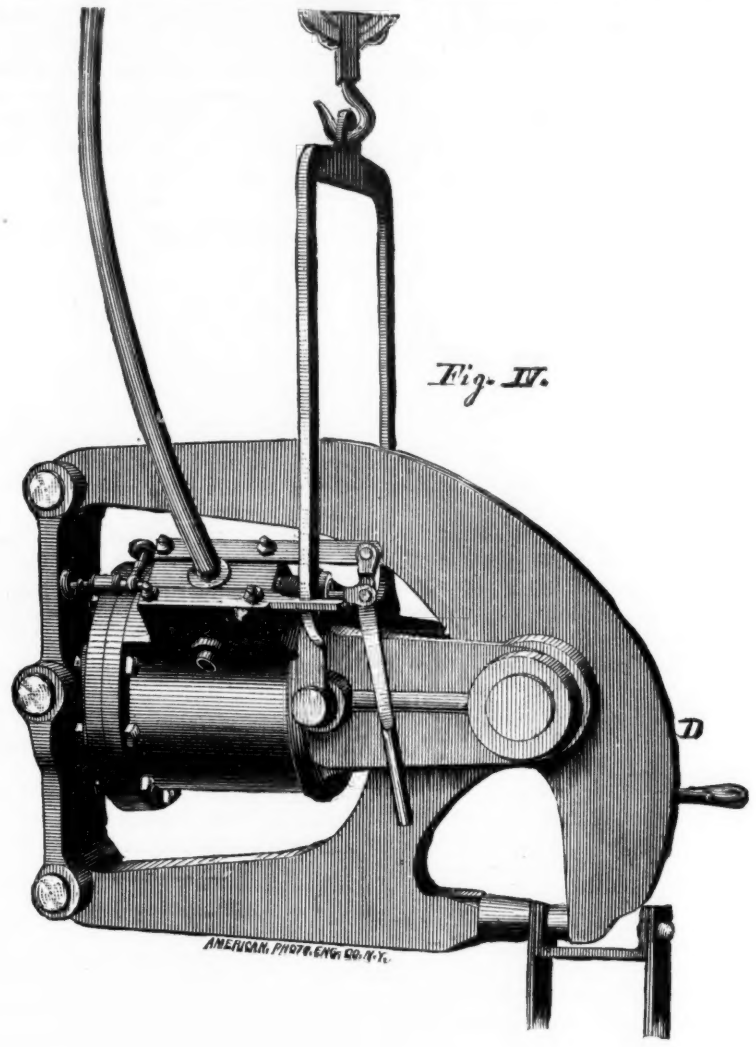


Fig. IV.

was lately exhibited and explained at the meeting of the Manchester Geological Society, by Dr. Angus Smith. The design of the instrument is taken from the old compression syringe used for igniting tinder, and the instrument consists of a small brass tube with glass let in at the bottom, which is closed up, and a piston and rod fitting closely in the tube. The air to be tested is taken into the tube either from the top or by means of a stop cock at the bottom, and the piston then rapidly pressed down with the hand, the compression of the air thus effected with the aid of spongy platinum, causing the gases to explode inside the tube, the explosion being visible through the glass let in at the bottom. Dr. Smith stated that the presence of gas down to 2½ per cent. could be detected by this instrument, and as the explosion within the tube was perfectly harmless he thought the instrument might afford a useful means for exploring gaseous mines.—*Universal Engineer.*

Shop Kinks, No. 3.

DEVICE FOR LINING UP GUIDES.

BY L. F. LYNE, M. E.

In lining up the guides upon new steam engines it is generally customary to stretch a line through the cylinder, setting it as near the center of the bore as possible, the guides then being carefully set by this line. In practice, there are few men who will perform the details of lining up guides so perfectly, but when the piston is put in place will require more or less adjustment.

To hold the piston exactly in the center of the cylinder, it is generally turned so as to fit the bore nicely, yet allowing it to move freely. This procedure does very well for engines where the cylinder and piston are new, or when the cylinder has been rebored and a new piston introduced, but when the engine has been in use for several years, the cylinder and piston being badly worn, other means have to be resorted to for accomplishing the above purpose.

In locomotives there is sometimes a space of $\frac{3}{8}$", and even more, about the piston between it and the cylinder. The cylinder is often of an oval shape, being worn out at the bottom, so that in some cases the vertical diameter will measure $\frac{1}{8}$" more than the horizontal diameter.

Some men, under these circumstances, will set the line referred to by the counter bore of the cylinder, which is erroneous, as the piston in operation bears no relation to the counter bore. If the guides be lined up by the counter bore, they will be found too high. The proper way to line the guides is by the bore of the cylinder, as that is the guide for the piston. When the guides have been placed in line, the piston should be put in place and the rod keyed fast to the cross head. The piston should then be raised to the center of the cylinder, and held in that position while it is moved from one end of the stroke to the other, to ascertain if all the parts are in line. There have been a number of devices used to hold the piston firmly in the center of the cylinder, some of which are good; but the most simple way ever witnessed by the writer is one made and used under his direction upon locomotives, and is illustrated by the accompanying engravings. A piston *a* is shown in Fig. 1, with the follower removed, and the devices *c c*, for holding the piston in position. Referring to Fig. 2, the reader will readily understand the simplicity of this arrangement; *f* represents a piece of flat iron, having one end bent at right angles to the body, and is

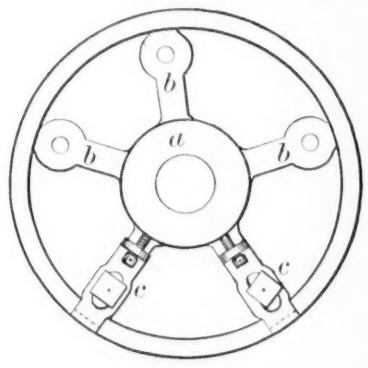


Fig 1

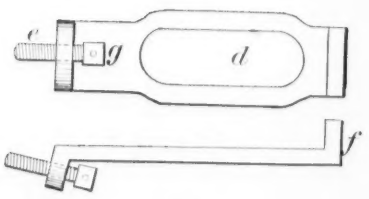


Fig 2

rounded to slide in the cylinder without cutting, while the other end is bent at an angle for the reception of a set screw *g*. The slot *d* is made oblong, so as to fit the piston of any locomotive, allowing the necessary space for adjustment.

The flat sides should be planed or filed parallel, so as to allow a free movement under a gentle pressure. The end *e*, of the set screw *g*, is intended to bear against the center projection upon the piston, as shown; but upon some pistons, where there is no such projection, an iron block may be placed between the screw and the projecting center. By making the end *f* so as to project inwards, the piston may be moved to the end of the stroke without dropping into the counter bore. When the piston is once set in position, and the follower bolts tightened, there is no danger of its getting out of line, as is the case with many other devices. A little tallow should be rubbed upon the ends *f*, to prevent scratching the cylinder. Should the projections *b*, *b*, *b*, upon the piston, not come in the position shown in the cut, or, in other words, should one of them stand directly under the center of the piston, it is better to use three supports, as they hold the piston more firmly, although two may be used with satisfaction.

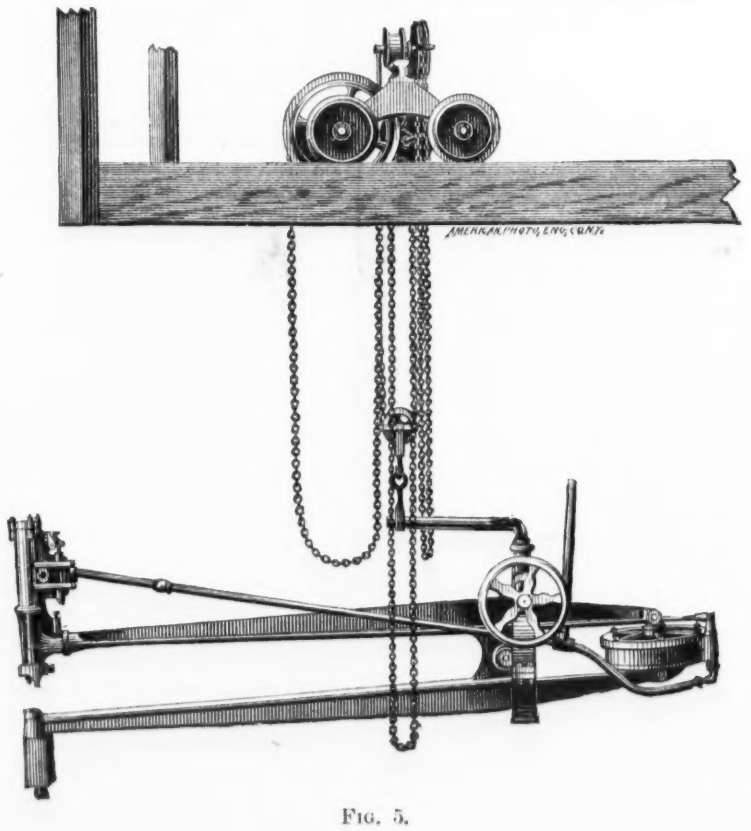


FIG. 5.

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NEW YORK, NOVEMBER 6, 1880.

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Our Railroad Progress.

There is no great industry in this country the ups and downs of which constitute a truer index of our industrial progress than railroading. As a nation, our substantial internal developments may be measured and compared with that of European nations, by a comparison of their railroad systems with our own. No other country in the world can boast of so many miles of railway and such an extent of traffic as can the United States. But, to our foreign friends, the rapid extension of our railroads, both in the thinly populated sections and in the oldest settled parts of the country, occasions the greatest surprise. The completion of nearly 4,000 miles of new road this year shows a prosperous condition of business interests. This fact is further shown in the almost universal increase of railroad earnings this year over the corresponding period of 1879, amounting to many millions of dollars. Only one line of any importance shows a decrease of earnings as compared with last year. The incorporation of new companies to build long lines of railroad is now a matter of almost weekly occurrence. The demand for iron and all the useful forms into which it is wrought, will be kept up and increased by these railroad enlargements and the requirements of the older roads. The resources of the Great West will be rapidly developed and the real wealth of the country thereby increased. Where it is desired to construct lines of road cheaply the two and three foot gauge are in very high favor.

The building of opposition lines to take part of the traffic from old roads is gradually silencing the cries of "railroad monopoly" and "freight discrimination." Taken as a whole there is cause to feel gratified over the present railroad progress.

Introducing New Machinery.

The practical introduction of improved machinery and tools, and appliances for engines and boilers, is a work of no small difficulty, as every individual of experience can abundantly testify. In earlier days prospective purchasers were expected to migrate to the warehouses and manufactories of machinery men, and find out what progress was being made in the direction of improvements, but they seldom do so now. Purchasers are first made acquainted with solid mechanical improvements by aid of printers' ink, and are afterwards appealed to in the most persuasive way by active and energetic traveling agents. The latter are not accustomed to receive their due share of credit for the successful introduction of new machinery, and we draw attention to the fact in the hope that more suitable recognition may be accorded them. The user of machinery, who has often been expostulated with by glib-tongued agents in the vain endeavor to induce him to buy a new cut-off for his engine, a fuel-economizer for his boiler, or a labor-saving combination machine for his shop, becomes almost callous to what one would suppose to be the most convincing logic, when again interviewed on the same subject. Every time he successfully resists the determined onset of a live machinery agent, he becomes more hardened in his opposition to a change in his mechanical arrangements, until he gets so firmly set that it requires far more eloquence and arguments to persuade him to purchase any new mechanism, than the average stump speaker displays in nailing fast the lies of the opposition party, and working up votes for his favorite candidates. The agent, who is striving to introduce some really valuable innovation upon long established usage, will be met with recitals of almost endless failures of other contrivances designed to accomplish the same result. He therefore needs to be well informed, not only upon the invention he seeks to induce customers to adopt, but upon everything else of the kind of which the general public has any knowledge, so as to be able to answer every objection arising from their familiarity with devices that "wouldn't work."

The adoption of the best machinery and mechanical appliances in most shops can be traced, largely, to the persistent efforts of intelligent machinery agents. They deserve to rank side by side with the inventors and manufacturers of the machines they push into practical use.

The Chief Gainers by Protection.

Among many workmen employed in shops which depend largely upon a protective tariff for their present business, a notion is prevalent that whatever employers favor, must necessarily be adverse to the interests of workmen. These men forget that if the present protective tariff were removed it would be vastly easier for the employers to screw their workmen down to the pitiless conditions that prevail in Europe, than for the workmen to live with any pretence at comfort for themselves or hope of education for their children, on the low wages they must inevitably submit to, under the stress of such competition.

In this world probably very few men are wholly philanthropic, or free from selfish bias in their economic views; but it is well that workingmen should realize that philanthropic regard for the welfare of their workmen, as well as personal profit, induces more manufacturers to favor protection than many of them had ever thought possible.

A Plumbing Banquet.

Some time since a party of gentlemen, belonging to a noted free trade club of New York City, conceived the happy idea of inviting a number of intelligent workmen to meet them at a little dinner, for the purpose, not of proselyting, but of comparing views upon the labor questions of the day. Six well-known gentlemen, of high social position, sat down to dine, and with them sat an equal number of intelligent workmen, selected at random from plumbing establishments in this city.

Soup was served and fish was brought on and speedily dispatched. Roast beef, fricaseed chicken, potato croquettes, and various other edibles were manfully met and promptly vanquished. Whether the tongues of the assembled twelve were unlocked with wine, or what not, we are uninformed, but when eating ceased and speech-making began, we have the word of one of the hosts for the statement that the best speeches of the evening were made by the six doughty plumbers. Whether this was directly due to a conception of their representative character on this occasion, or whether much charging of weighty bills and much practice in finding arguments to support the same, was the cause, we do not know.

However this may be, the little affair passed off so handsomely that another and larger dinner of the kind is talked of, at which fifty persons upon each side will be present. But it is safe to assume that the members of the club issuing the next invitation will be more mindful of sundry past unsuccessful encounters with members of the plumbing fraternity than they appeared to be on this occasion, and will not confine their courtesies to such narrow limits.

Newspaper Overcoats.

The cool days of autumn advance apace, and a number of our newspaper and magazine exchanges are improving the season by a timely donning of their fall overcoats. About the worst color which has yet appeared is the golden-brindle, which adorns the November issue of *Scribners*. Most of our English technical exchanges, influenced doubtless by the climatic peculiarities of the "tight little island," wear, the year round, a sort of ulster, which is seldom or never changed. In this country, the smoky air of Pittsburgh involves more frequent changes in the color and style of newspaper overcoats than any other of which we have knowledge. Some of our milling exchanges are very neat and seasonable in their changes of costume. Altogether, it is a good fashion, as whatever tends to improve the exterior appearance of technical or literary journals, is likely to stimulate attention to inner details, and popularize the habit of reading in our American communities.

Another International exhibition of flour-mill machinery will be held in the early part of May next, this time in Agricultural Hall, London. No premiums of any kind are to be awarded, but power and every other facility is to be afforded exhibitors to show their machinery in operation. The exhibition is to be held under the auspices of the National Association of British and Irish Millers.

A Training Ship for Marine Engineers.

One of the important things to be secured, when the American people get their minds thoroughly made up on the best method of reviving our ancient shipping prosperity, is a greater number of men skilled in the management of the machinery required in steam vessels. A training ship, which would undertake the practical, as well as the theoretical, education of young men anxious to qualify themselves to take charge of steam machinery at sea, would be a valuable contribution to the movement for the restoration of American shipping interests.

Nothing is better settled than that, for the most part, steam must inevitably supersede sails at sea. The vast extension of railroad interests in this country, during the past few decades, presents a fitting parallel to the tremendous development of which our maritime interests are capable, when the needed start is once fairly made. Thousands of trained mechanics contribute their skill to the successful working of American railroads. Thousands more should contribute theirs to the successful working of American steam vessels. No better preparation can be devised than the training that a single floating school of this character could give to hundreds of active young men, were the opportunity offered. Instead of resolving in favor of direct subsidies that will never be granted—and that would defeat the main object of their advocates, if granted—our shipping conventions of the future will do well to bestow some consideration to more practical, if humbler, branches of the subjects under discussion.

One of the prosperous signs of the times is the largely increased importation of foreign goods, showing a corresponding increase of purchasing power among the people. Under our system of protection to home industry, not only are domestic manufactures built up and made to flourish, but a healthy foreign trade is sustained. The greater the distribution of wages, the more goods will be bought from abroad as well as from home manufacturers.

The November Meeting of the Engineers' Society.

The chairman of the committee appointed for the purpose of securing rooms, in which to hold the first annual meeting of the American Society of Mechanical Engineers, informs us, that Room 24 of the Cooper Union has been engaged for this purpose. Arrangements are also pending to secure the refusal of a larger hall to adjourn to, for the reading of papers after the strictly business meeting.

It is to be hoped the committee will go further, and secure the large hall of the Cooper Union for the evening session, and invite the mechanical public generally to be present to hear the papers read and discussed. There are thousands of practical mechanics in this city and vicinity, who would be interested in the proceedings of the society, and who are in position to reduce the theories of the engineers to practice. A large attendance of the membership is promised, and many valuable papers are to be read.

The business meeting will take place Thursday, November 4, at 10 A.M.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1.) C. G , Mechanicsville, N.Y., writes: I am informed, from a supposed reliable source, that if locomotive runners would see to it and keep the valves properly oiled, then always let the lever down in the corner (forward motion) when running without steam, that the valves would *never* wear rounding and the seats hollow. My experience has never proved this to be so. Am I mistaken? *A.*—The decision of your adviser is conclusive evidence that the person knows little concerning the operation of locomotive slide valves. When a locomotive is using steam, the lever is so adjusted to give the valve the least travel possible and do the work required. Under these circumstances the friction is greatest, hence the valves and seats wear the most. When steam is shut off and the engine is required to run any considerable distance the lever is thrown down to full stroke, and oil or tallow introduced to prevent the surfaces being destroyed. The wear of the valve and seat when the engine is running without steam amounts to very little, as the friction is then only due to the weight of the valve. The chief cause of the valve and seat wearing hollow is, viz.: The yoke being attached some distance above the seat, and the resistance being at the junction of the two surfaces the result is that when power is applied to the yoke to move the valve, the tendency is to roll the valve over upside down, which is prevented by the pressure of the steam upon the top. The effect is to wear away both edges of the valve leaving it high in the center. When the engine is reversed while in motion, dirt and soot are drawn into the cylinder from the smoke stack, which causes the bridges to be worn away. In some engines in which a poorly designed cast-iron packing is used, when the engine is using steam, a final cloud of cast-iron, which is scraped from the inside of the bore of the cylinder, fills the inside of the cylinder and steam chest, also causing the surfaces to be rapidly destroyed. All the foregoing conditions have their influence in causing the valves and seats to wear hollow.

(2.) W.R.Y., Honeoye Falls, N.Y., writes: I would like to have you explain the present method of dividing the index wheel used upon gear cutters. It would seem by the illustration in No. 36 of the AMERICAN MACHINIST, that a different plate would be required for every different size that was required to be cut. If you can explain so that an ordinary mechanic can understand it I shall be very much obliged. *A.*—In the article referred to Mr. Harrison describes the operation of laying out only one row of holes in the index plate, as the same procedure would be necessary for the other holes. If a person wishes an index plate at the present day, the best and cheapest way is to turn up the plate, then send it to some fine tool-maker and have it drilled. One of the oldest manufacturers in this country who makes a specialty of index plates, uses as a standard an original index plate, which was graduated in Washington, D. C., some years ago. All the graduations upon new index plates are taken from it. To lay out the holes for a new index plate involves the use of very fine microscopes, with cross wires and other instruments, besides being a long and tedious operation. The method described by Mr. Harrison is about as simple as any other reliable way.

(3.) A J. B., Bordentown, N. J., writes: Please inform me: Is it advisable to oil gear wheels in a lathe or drill press, or not? The other day at noon, as all hands were sitting in the shop, one of the apprentice boys went to an old journeyman and asked: "Would that lathe not run easier if I were to oil the gear wheels? and the answer was, "Yes." Instantly there were several other men who said to the apprentice, "Don't do it Jack, as it ignites the wheels. Let them run perfectly dry, they will wear longer and at the same time run just as easily." They argued for full half an hour, and I thought the arguments about equal when the whistle blew, thus preventing a decision. Which is right? *A.*—There is one law in mechanics which will never change, and it is this. Where any two surfaces of metal rub or slide against each other, lubrication is required, otherwise those surfaces will become dry, causing abrasion, tearing each other to pieces. All gearing should have some lubrication, however slight, but enough to keep a thin film between the surfaces. We are acquainted with a certain machinist who never oiled the leading screw upon the lathe upon which he was at work. The foreman observed some dust upon the screw caused by cutting, and asked the workman if he did not oil it, and his reply was that he "never heard of putting oil upon a leading screw." This illustrates some of the peculiar and erroneous ideas that prevail among workmen.

(4.) A. R., Jackson, Mich., writes: I had to make a worm gear, which required 29 teeth of ½ inch pitch. Haswell, on page 513 of his pocket-book, gives what I thought was the required information, but the gear I produced by his rule had 31 teeth instead of 29. Now it is evident that I do not understand how to apply the table for a worm gear, or do not know where the pitch line should be located; therefore I ask you for the desired information. I cut and tried until I got the wheel right, which, when done, measured 1.25" outside diameter, I think, at the center of the face. If you will take the trouble to tell me where the pitch line is, and how to find it, I will be greatly obliged. *A.*—The pitch line of a worm wheel is the pitch line at the smallest diameter; or, in other words, if a worm wheel be divided through the center of the face, the pitch line may easily be measured in the usual way upon the section. A description of the worm and wheel together, with full directions for laying out the same, was published in the AMERICAN MACHINIST of February 7th, 1880, under the title. Operation of the Worm and Wheel, by Hermann T. C. Kraus.

Business Specials.

50 cts. a line for each insertion under this head.

Shafting straighteners. J. H. Wells, Vineland, N. J.

Wilkinson & Crowell, No. 506 Walnut St., Philadelphia. "Paragon" Piston-rod Packing, entirely metallic, automatic, frictionless, and practically free of steam pressure. Will work on high-speed or condensing Engines.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

Egbert P. Watson being disengaged, will take the agency of any first-class machine requiring energetic and intelligent prosecution to place it before the public. Address at Elizabeth, N. J.

Richards & Dole, Springfield, Mass., designers and builders of machinery, make a specialty of inventions and improvements. Manufacturers and inventors write for particulars.

Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

Blowers for all purposes. Exeter Machine Works, 50 Federal Street, Boston.

American Watch Tool Co., Waltham, Mass., Whitcomb Watch Makers' Lathes, and Watch Machinery.

See Christiana Machine Co.'s adver., next number.

Vertical and Horizontal Pumps. Capacity from 100 to 35,000 galls. per minute. Simple, Efficient, Economical, Durable. Used by more than half the tanners and paper makers of the country. Horizontal and Vertical ENGINES, from 10 to 30 H. P., for long continued hard work. Prices, 40 per cent. below other makers. Send for circulars. Heald, Sisco & Co., Baldwinsville, N. Y.

All makes and sizes of Steam Hammers bored out. L. B. Flanders Machine Works, Philadelphia, Pa.

Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

Rules for Engineers, and Removal of Scale in Boilers. Send for Circular. Ranken Scale Co., 50 Federal Street, Boston.

Dixon's Traction Belt Grease. Dixon's Founders' Perfect Wash. Dixon's Plumbago Foundry Facing. Dixon's Graphite Machine Grease. Dixon's Everlasting Graphite Axle Grease. Dixon's Dry American Graphite Perfect Lubricator. Send for explanatory circular to Dixon Crucible Co., Jersey City, N. J.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, the author, Manchester, N. H.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

Engines Indicated—Power Measured. W. H. Odell, Box 274, Yonkers, N. Y.

John Douglass, common and fine patterns made to order, also car wheels, working models, and experimental machinery. Shop at 83 Morgan street, near Washington, Jersey City, N. J.

MANUFACTURES

The Keystone Spike Works, Alliance, O., will turn out this year 16,000,000 threshing machine spikes.

At Norwalk, O., it is rumored that a new factory is soon to be started for the manufacture of organ attachments.

McGraw & Son, McGrawville, N. Y., are to build an addition sixty feet long to their two-story corset factory. They are overrun with orders, and need more room.

Upon the result of the presidential election, says the Chicago *Industrial World*, it is claimed, depends the establishment here of a new company composed of Eastern capitalists and manufacturers with a capital of $500,000, for the manufacture of bolts, nuts, locks, nails, and hardware specialties.

The Pittsburgh Forge and Iron Company is about to put up an addition to their bolt department at Verner Station, Pa., which will greatly increase their capacity.

The owners of the Southampton, N. S., Woolen Mills intend to introduce steam power.

The Westinghouse automatic air brake has been fitted on 456 English engines and 2,942 cars; in France on 203 engines and 1,609 cars; in Belgium on 197 engines and 1,241 cars; in Germany on 55 engines and 93 cars; in Russia on 36 engines and 51 cars; in Holland on 28 engines and 117 cars; on New South Wales government lines on 23 engines and 18 cars. In the United States it is used by 130 railways on 2,211 engines and 7,224 cars. With a few on the lines of several other countries, the totals are 3,237 and 13,502, while the non-automatic system is fitted on 2,472 engines and 8,842 cars.

The Enterprise Manufacturing Company, of Philadelphia, manufacturers of hardware specialties, have completed a large addition to their works. They now employ over 300 hands.

The Union Iron and Steel Company are erecting a building on the corner of Ashland avenue and 31st street, to be used for manufacturing railroad frogs, crossings, switches, etc. It is 60 by 100 feet in size, and has a capacity for turning out 15 to 20 frogs per day. The two new blast furnaces now being erected by this company will be ready to blow in about December 1. Their joint capacity is 200 tons per day. These furnaces are provided with six Whitwell hot blast stoves—three for each furnace.—*Chicago Industrial World.*

The Cocheco Manufacturing Company of Dover, N. H., are now building a new mill of 26,000 spindles, 286 by 74 feet and four stories high. This structure is to be a part of the proposed new mill to contain 58,000 spindles, which will be an increase, when completed, of 18,000 spindles. Then the company will have 120,000 spindles in all, and will employ 1150 hands in the mill and 500 in the print works, the whole number of employees being 1,800. About one half the machinery required will be new.—*Boston Commercial Bulletin.*

The Fairbanks Scale Company, St. Johnsbury, Vt., have put a new engine into their foundry. They are now employing 600 men

Ford & Co., Tippecanoe City, Miami county, manufacturers of the Guard Wire Band Hub, have extended their buildings and added new machinery. They are now filling an order for fine wheels to go to Warnsdorf, Germany. They employ 75 to 100 hands.—*Cleveland Trade Review.*

The recent International Exhibition of gas apparatus, hot air and water motors, in Glasgow, Scotland, attracted considerable attention. We take the following from the Glasgow *Herald* regarding one of the exhibits:

The engine exhibited by Messrs. Thomson, Sterne & Company, London, Paris and Glasgow, is undoubtedly a novelty. In fact it is the latest invention of Capt. Ericsson, the famous Swedish engineer, who now resides in America. This is the simplest power ever invented. There is neither outlet nor inlet to the cylinder. The air which it contains is alternately heated or cooled, and this is achieved by a displacer working loose in the cylinder, which alternately displaces the heated air, from the bottom of the cylinder to the underside of the piston, at every stroke, the upper portion of the piston being open to atmospheric pressure. The little pump exhibited is capable of 200 gallons to a height of 25 feet every hour, and gives a continuous stream. The water thus pumped plays an important part in the engine, for it surrounds the upper part of the cylinder and thus cools the air inside. This engine, the fitting parts of which are all external, is being made from the smallest size up to one capable of pumping 10,000 gallons per hour. The exhibitors represent Capt. Ericsson in Europe and the colonies.

Nilson, Parsons & Co., proprietors of The Pembroke Iron Foundry, Bridgeport, Conn., manufacturers of fine light gray iron castings, have lately received several large orders for sewing machine castings, which necessitate the enlargement of their works to double their present capacity. They are now supplying several out-of-town parties with castings, among them The Farmer & Gardner Manufacturing Company, Springfield, Mass.; The Henry Stewart Manufacturing Company, New York, and Trump Bros. Manufacturing Company, Wilmington, Del.

The Tanite Co., of Stroudsburg, Pa., has just received an order for one of their improved surface grinders from the Danforth Locomotive Works. This machine is intended to perfect locomotive slide bars, and is the second one of the kind; the first, we believe, having gone to The Baldwin Locomotive Works. The Tanite Company is also busy at the present time in filling an order for nearly three tons of Tanite emery wheels for the French government.

The Watertown (N. Y.) Steam Engine Co. are enlarging their works to increase the capacity. They are working with a large force night and day, yet are unable to keep up to their orders.

Ground was lately broken three and a half miles west of Binghamton, N. Y., for the extension of the Delaware, Lackawanna & Western Railroad to Buffalo. James N. Smith, a Brooklyn capitalist, superintendent Halstead, chief engineer Archibald, and others were present and took part in the ceremonies. Superintendent Halstead threw the first shovel of dirt, when all the officers present helped to load the first cart. Work also was begun for a bridge across the Chenango river. The force of men at work will be largely increased immediately, and the work pushed along the whole line.

Iron is on the way to complete the North Wisconsin road as far as graded, which will bring the track to within 35 miles of Bayfield. Daily stages are to be run this winter between the end of the track and Bayfield, and the railroad will be extended to Bayfield next season. This road has just reached the vicinity of a large white cedar swamp, which will furnish an immense amount of timber. The Northwestern Telegraph Co. is negotiting for all the telegraph poles the swamp will furnish, and the Union Pacific R. R. wants all the ties. The swamp is owned by parties controlling the Northern Pacific.

The Pittsburgh Southern narrow gauge road now extends from Pittsburgh, Pa., to Washington, 36 miles. The company has 15 miles of road bed ready for track laying, and 800 tons of rails delivered and 15 tons additional either on the way or ordered, to be laid this year. It is expected to put 45 miles more under contract.

The New York & New England Railroad extension to the Hudson river will be opened to Brewster's, N. Y., December 1. Grading to Hopewell Junction, 25 miles further, is well under way. To reach Fishkill, on the Hudson, from Hopewell Junction, 13 miles of the track of the Newburg, Dutchess & Connecticut road may be used, or a new road may be built. There have been some movements looking to the lease of a portion of the Newburg road by the New York & New England.

The new steel rail mill at Puebla, Colorado, is rapidly approaching completion. The stacks are now being put into position. Iron ore is found in great abundance in the vicinity of Leadville.

Coal exposed to the weather undergoes a slow combustion, in which the volatile constituents—which are the most valuable combustible elements—are gradually eliminated, while the relative proportions of carbon, ash and sulphur are comparatively augmented. Anthracite suffers the least waste from exposure, cannel ranks next, while bituminous varieties are the most susceptible.

NEWLY INCORPORATED MASSACHUSETTS COMPANIES.

The Union Oil Cup Company, Boston. Hobart M. Cable, president; Edwin A. Chase, treasurer. Capital, $125,000, in shares of $100 each. For the manufacture of machinery and lubricators therefor. Oct. 13th.

The Sewing Machine Supplies Company, Springfield. Henry S. Safford, president; Fred O. Flagg, treasurer. Capital, $7,500, in shares of $100 each. For manufacturing and selling sewing machines, parts, attachments and accessories. Oct. 14th.

The Wauregan Paper Company, Holyoke. James H. Newton, president and treasurer. Capital, $100,000, in shares of $100 each. For the manufacture and sale of paper. Oct. 16th.

Machinists' and Engineers' Supplies.

NEW YORK, October 21, 1880.

The supply market is steady, and orders from all over the country are being rapidly received, particularly from the west. Some of the manufacturers experience great difficulty in filling as it is extremely difficult to procure skilled mechanics for special classes of work.

James Beggs & Co., 8 Dey street, have taken the sole agency for the Detroit continuous feed lubricator cups for lubricating the cylinders of steam engines.

Iron Review.

NEW YORK, October 21, 1880.

The pig iron market does not improve; on the contrary there is little being done in the way of sales. The cheapness of foreign irons is a serious obstacle in the way of any advance in prices. Prices are now about as low as they can be without loss to the manufacturers. We continue to quote Foundry No. 1, at $25; Foundry No. 2, $20; Grey Forge, $19.50 to $20.50. The trade in manufactured iron is very small. Dealers are inclined to hold their stock, believing that an early revival in the iron trade will soon occur. Prices are unchanged.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of Oct. 21, 1880:

We confirm our report of the 14th inst. Pig Tin in London, £89.; Singapore, $27.25. Would quote spot market: Banca Tin 24¾c.; Malacca and Straits 20c. to 20¼c.; Australian, 19⅞ to 20c.; Billiton, 19¾c. to 20c.; "Lamb & Flag" 19¼c.; Pig Lead, 5c. to 5¼c.; Antimony, 14½c. to 15½c., as to brand. Spelter, 5½c. for Domestic; 8c. to 8¼c. for "Bertha," pure, and 6c. for Silesian; No. 1 Solder, 11c.; "Half and Half," 13c.; Bismuth, $2.50 to $3.00.

WANTED.

Wanted—Machinists—Six strictly first-class Vise hands and Fitters accustomed to building machine tools; liberal wages paid by Niles Tool Works, Hamilton, Ohio.

Wanted—Situation by young Scotchman as Junior Draughtsman, 6 years in shops and 2 in drawng room of general engineering works. Small salary accepted. X Y Z, care AMERICAN MACHINIST, 96 Fulton St., New York.

Mechanical Draughtsman. Wanted. An active young man of ability who has had some practical experience in a machine shop drawing room. A desirable opening for the right party. Address, 414 Water Street, N. Y.

Wanted.—A reliable second hand Richards Indicator. Address with price and particulars, C. W. N., office AMERICAN MACHINIST.

A PARTNER WANTED.

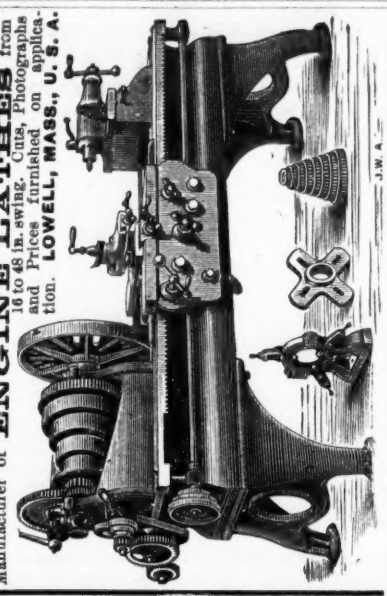
The undersigned is proprietor of an extensive machine shop, foundry, blacksmith shop, &c., in Fond du Lac, Wis., stocked with first-class Tools, among which is a Planer for planing 20 feet long, 4 feet wide and 4 feet high, made by the Putnam Machine Co., also a Lathe of 7 feet swing and 20 feet bed, made by the same company. *The shops and Tools are nearly new*, and now running on Engines, which it is intended to make a specialty of manufacture, but owing to the pressure of other business the proprietor is *unable to give his personal attention* to the same, and, therefore, wishes to associate with himself a practical business man of experience in this line to take charge of the business, and who could also furnish a portion of the capital required. The business is free from all indebtedness, and the principal part of the capital necessary for operating the works can be furnished by the present proprietor. Address,

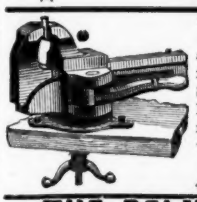
CHARLES J. L. MEYER, Fond du Lac, Wis.

September 25, 1880.

GEO. W. FIFIELD,

Manufacturer of **ENGINE LATHES** from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. **LOWELL, MASS., U. S. A.**





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Stephens' Patent Vise Co.

41 Dey St., New York, U. S. A

THE BELMONTYLE OIL

Prevents Rust, Tarnish, &c., on Fire Arms, Machinery, Tools, Cutlery, Safes, Saws, Skates, Stoves, Hardware, &c., without injury to the polish. In use over 10 years. Highest Testimonials. Samples 50 cents, three for $1.00, sent free of expressage. Send for circular.

Belmontyle Oil Co.,

SOLE MANUFACTURERS,

150 Front Street, New York.

WILLIAM COOKE,

(Successor to COOKE & BEGGS),

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AGENT FOR

The Waters Perfect Governor,

Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats.

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For Machinists, Railways, Mills, Mines, &c.

Please send for circular and state that you saw the advertisement in this paper.

ANEMOMETERS OR AIR METERS

For measuring the velocity of air currents in mines, sewers, hospitals, etc. Instruments of precision used in civil and mechanical engineering imported and manufactured by

JAMES PRENTICE,

164 BROADWAY, NEW YORK.

JAMES BEGGS & CO.

Practical Mechanical Engineers,

MACHINISTS AND DRAUGHTSMEN,

Manufacturers and Dealers in

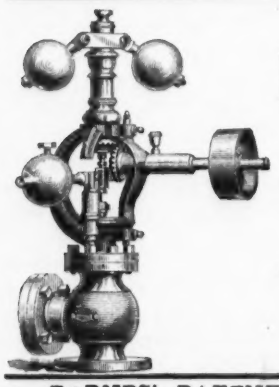
Railway and Machinists' Supplies,

WAREROOMS, 8 DEY STREET, NEW YORK.

SOLE AGENTS FOR THE

Detroit Lubricator, Excelsior Tube Scraper, Gardner Governor, Roots' Blower, Rowland Engine. Selling Agents for Roots' Patent Rotary Blower.

Illustrated catalogue and price list on application.



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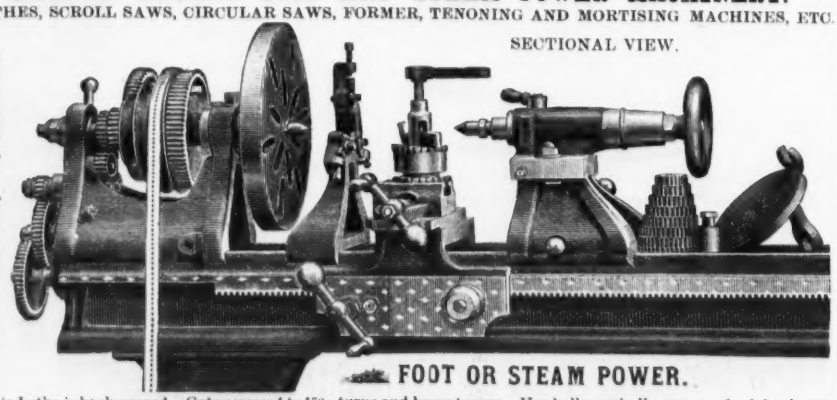
LATHES, SCROLL SAWS, CIRCULAR SAWS, FORMER, TENONING AND MORTISING MACHINES, ETC.

ENGINE LATHE No. 5. PRICE, $100.

SECTIONAL VIEW.



FOOT OR STEAM POWER.

This Lathe is back geared. Cuts screws 4 to 150; turns and bores tapers. Has hollow spindle, reverse feed, back rest. Swings 9x34 inches. Workmanship and material first-class in every respect. Descriptive Catalogue sent FREE.

Address, **W. F. & JOHN BARNES, Rockford, Ill.**

MORSE TWIST DRILL & MACHINE COMPANY,

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Sole Manufacturers of

MORSE PATENT STRAIGHT-LIP INCREASE TWIST DRILL,

Beach's Patent Self-Centering Chuck, Solid & Shell Reamers.

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Drills for Coes, Worcester, Hunter and other Hand Drill Presses. Beach's Patent Self-Centering Chucks, Center and Adjustable Drill Chucks, Solid and Shell Reamers, Drill Grinding Machines. Taper Reamers, Milling Cutters and Special Tools to order.

All Tools Exact to Whitworth Standard Gauges.

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T. NEW'S PREPARED ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

Mechanical Books.

Send 10 cents for 96 page Catalogue of Books for Machinists and Engineers.

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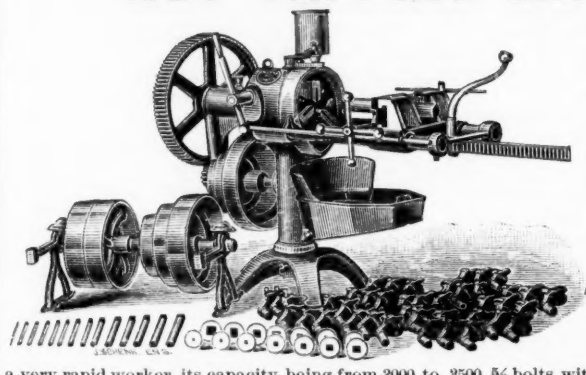
HOWARD IRON WORKS, BUFFALO, N. Y.

MANUFACTURERS OF

Schlenker's Revolving-Die Bolt Cutter AND NUT TAPPING MACHINE.



OUR NEW REVOLVING-DIE MACHINE is now recognized by practical machinists to be the perfection of a Screw Cutting Machine, and we now challenge the world to produce its equal. It possesses many advantages over any competitor. The dies are opened automatically when the desired length of thread has been cut on the bolt, and are closed by the lever, or automatically, as shown in the cut of the machine. It can be changed from one size to another in less than a minute without removing a bolt or pin. It does not require skilled labor, but can be operated by any competent boy. The dies are arranged to open and close automatically, therefore do not require the constant attention of the operator. It is a very rapid worker, its capacity being from 3000 to 3500 ⅝ bolts with 1⅗ inches of thread per day—and larger bolts in proportion. Threads cut by these machines will not vary ½ thread in length on ten thousand bolts. The machines are simple in construction, very compact and strongly built, and are offered much below the price of any other machines capable of cutting the same sizes, and amount of work. It is adapted to cut right and left hand, V thread, square threads, and coach screws,—will take in crooked as well as straight work, and cut any length of bolt. The machines are now largely in use, and we offer them to the trade as one of the most complete machinists' tools in the market. Every machine is warranted as recommended.

HOWARD IRON WORKS, Buffalo, N. Y.

Illustrated Catalogue sent on Application.

KEARNEY & FOOT

Office, No. 78 Chambers Street, N. Y. **Full Weight Hand-Cut Files.** Manufactory, PATERSON, N. J.

The best and cheapest in the end. Send for quotations. The files speak for themselves in the following testimonials. Read them.

MESSRS. KEARNEY & FOOT, Brooklyn, N. Y., May 24th, 1877.

Gentlemen:—We have used your Files, more or less, for several years, and we take pleasure in saying that both the new and re-cut Files have given entire satisfaction. Yours truly,

BLISS & WILLIAMS.

FARREL FOUNDRY AND MACHINE CO.

JAS. D. FOOT, Esq., Waterbury, Conn., Nov. 8th, 1878.

Dear Sir;—Please forward the order for Files given you a few days since. Your Files have been uniformly satisfactory to us. Yours respectfully,

FARREL FOUNDRY & MACHINE CO., E. C. LEWIS, Ag't.

We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.

Respectfully, **KEARNEY & FOOT.**

BETTS MACHINE CO., WILMINGTON, DEL.

MANUFACTURERS OF

STANDARD GAUGES,

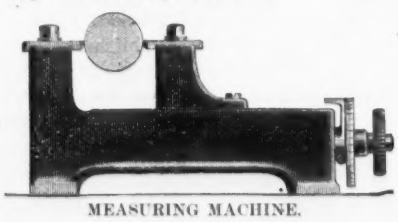
MEASURING MACHINES & ADJUSTABLE REAMERS.

STANDARD GAUGE.

Any size from ¼ in to 6 in.

CORRECTIVE GAUGE.

The disks are ground separately. Any combination of sizes can be made.



MEASURING MACHINE.

Sizes, 0 to 4 in., 0 to 12 in., 0 to 24 in. Can indicate to $\frac{1}{10000}$ of an inch.

ADJUSTABLE REAMER.

Any size from ½ in. to 2½ in.

Size Maintained by Blade Adjustment.

Will Outlast the Solid Reamer.

Shank Ground to Standard Size.

KEEP SIZES RIGHT and thus CHEAPEN PRODUCTION.

SEND FOR CIRCULAR.

NICHOLSON FILE CO.

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS and SPECIALTIES.

"Nicholson File Co's" Files and Rasps.
"Double Ender" Saw Files.
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"Racer" Horse Rasps.
Handled Rifflers.
Machinists' Scrapers.
File Brushes, File Cards.
Surface File Holders.
Vice File Holders.
Stub Files and Holders.
Improved Butchers' Steels.

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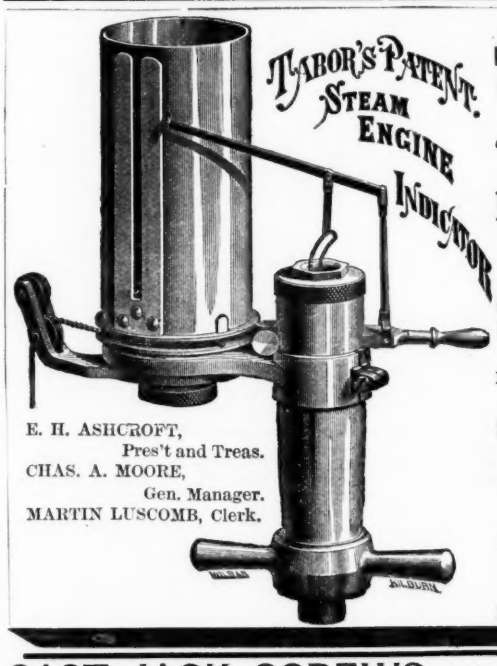

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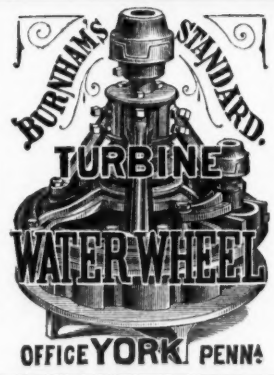

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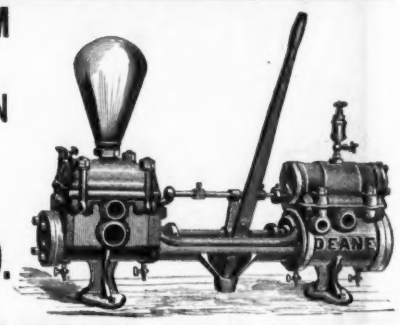

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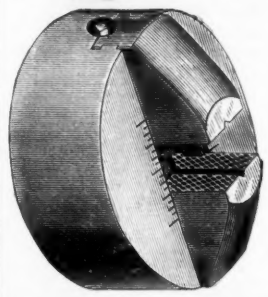

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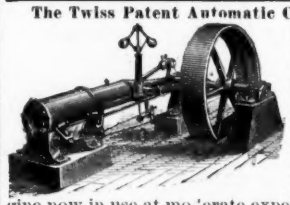

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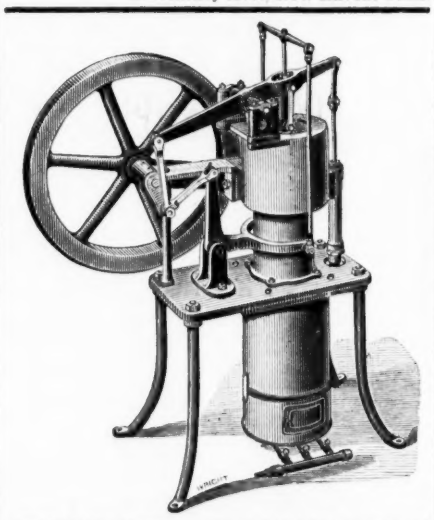

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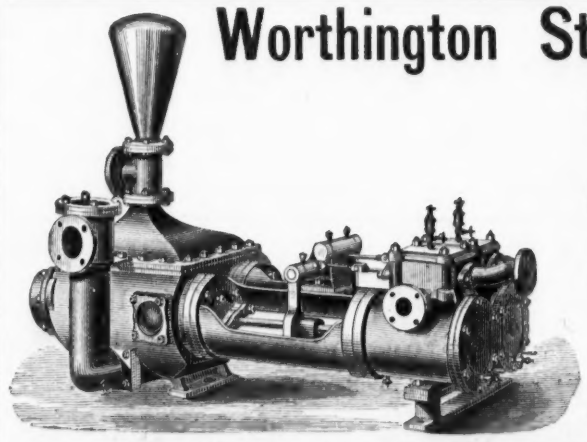

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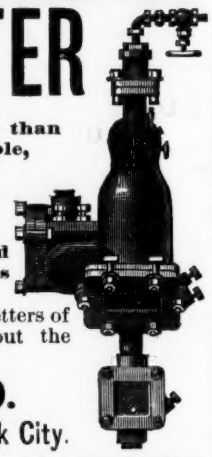

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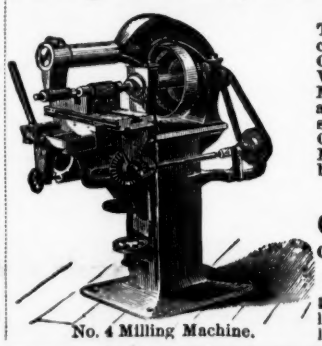

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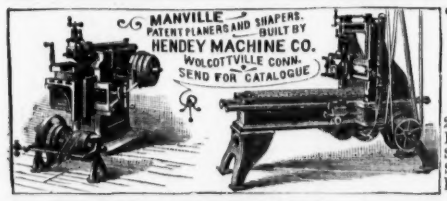

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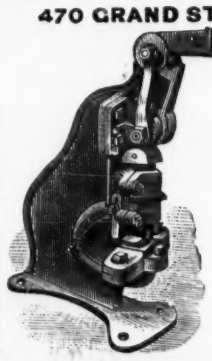

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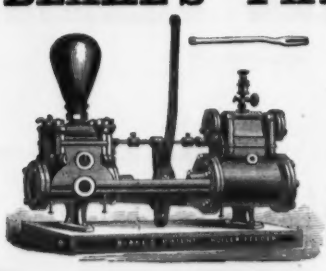

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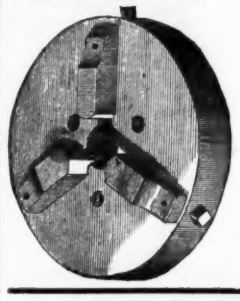

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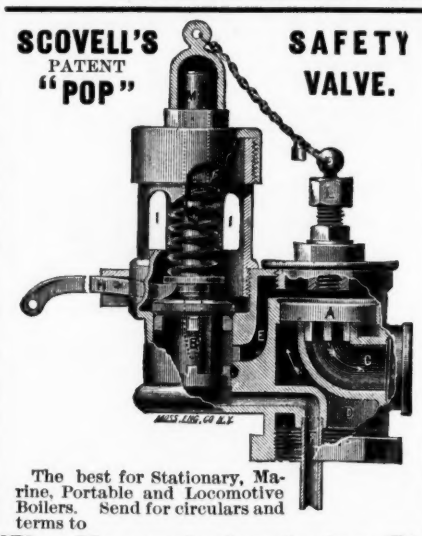

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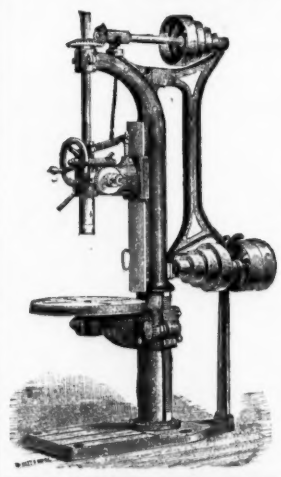

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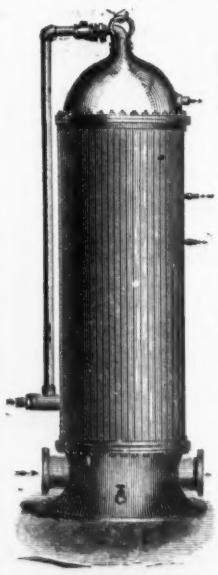

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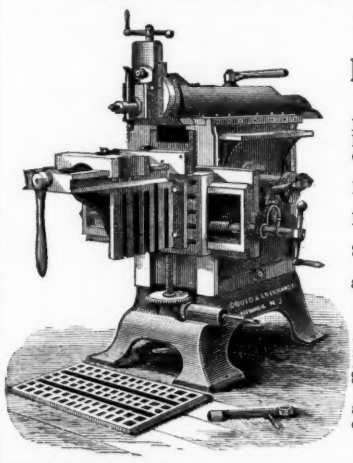

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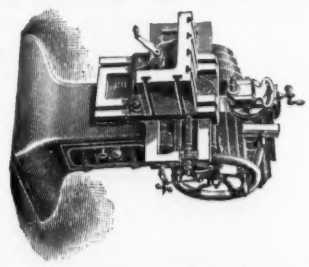

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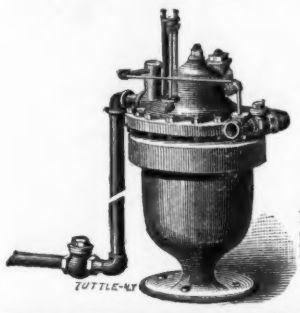

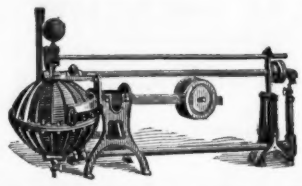

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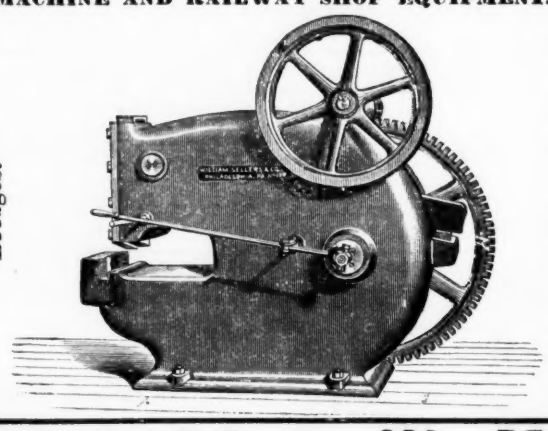

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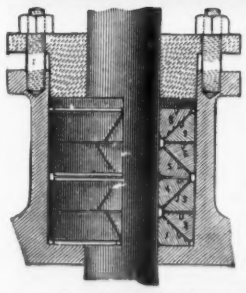

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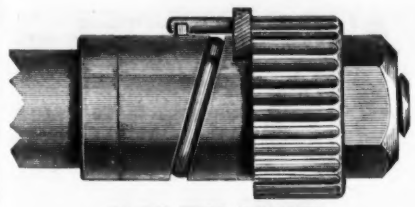

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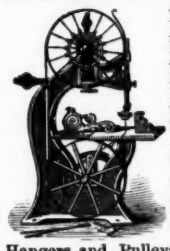

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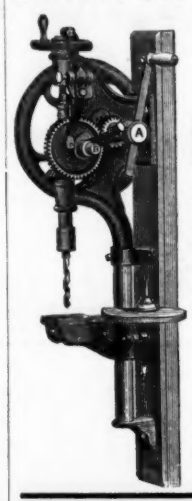

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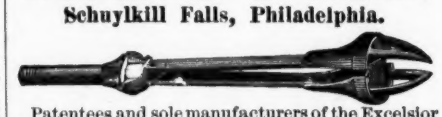

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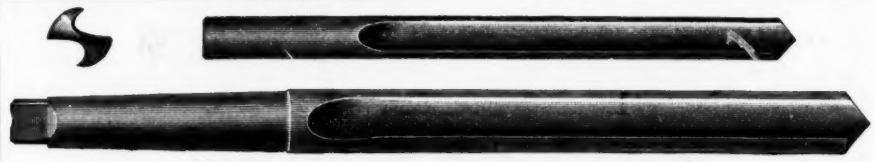

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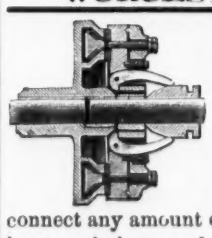

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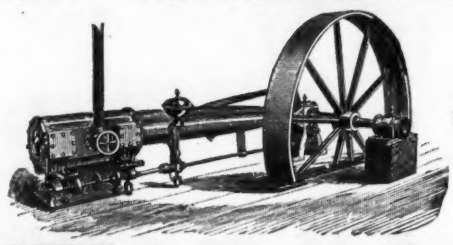

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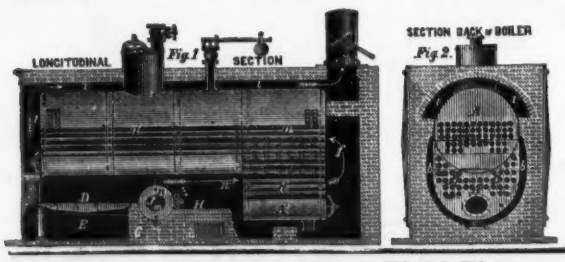

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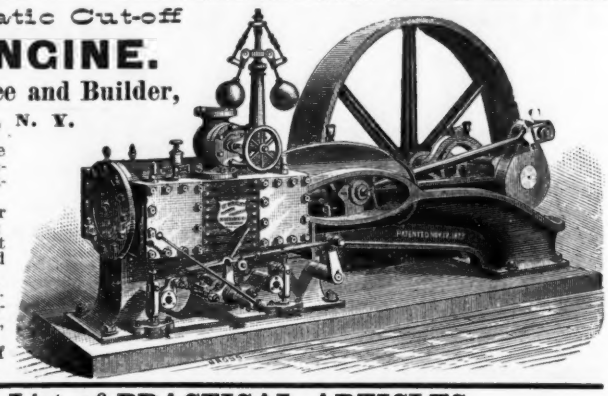

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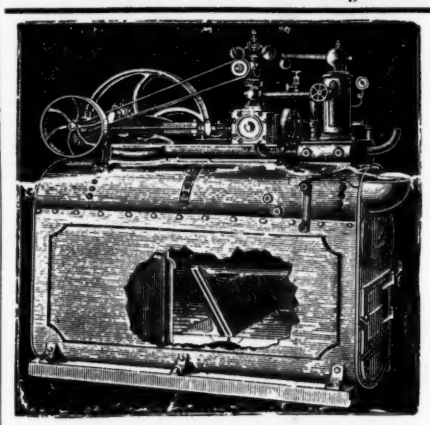

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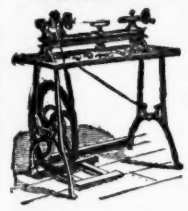

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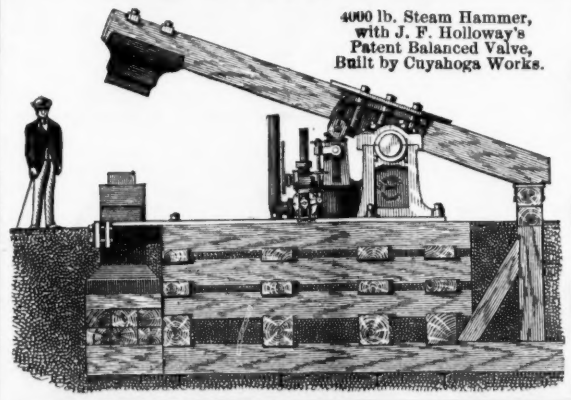

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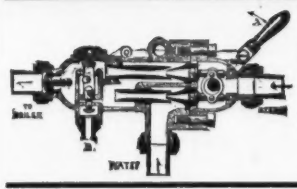

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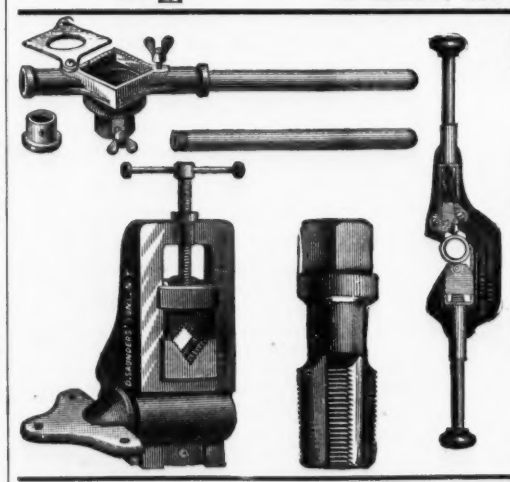

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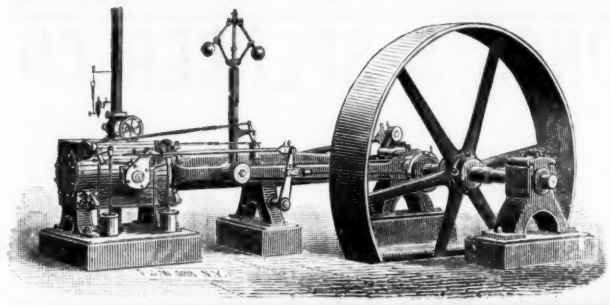

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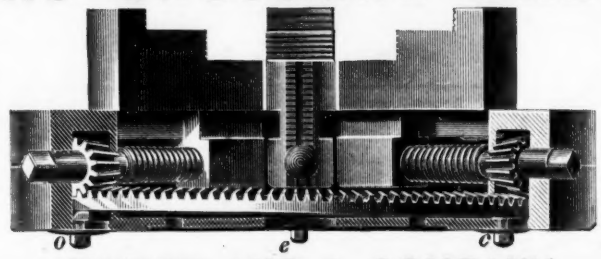

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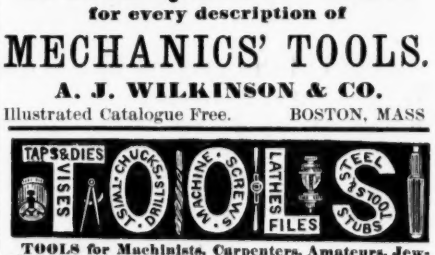

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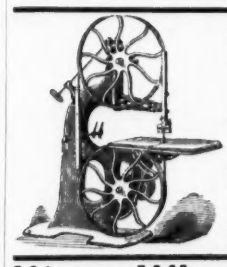

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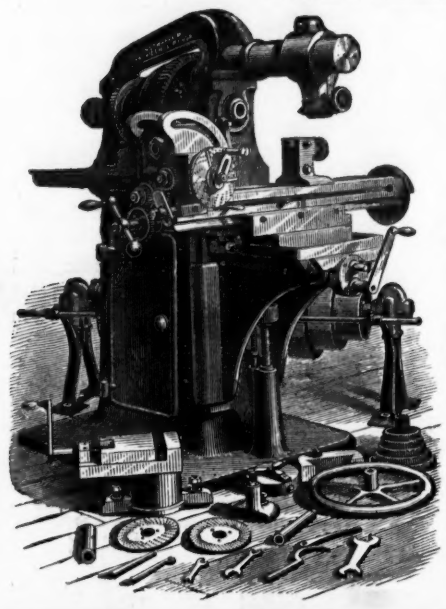

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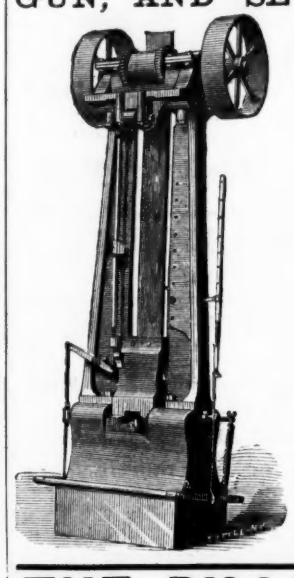

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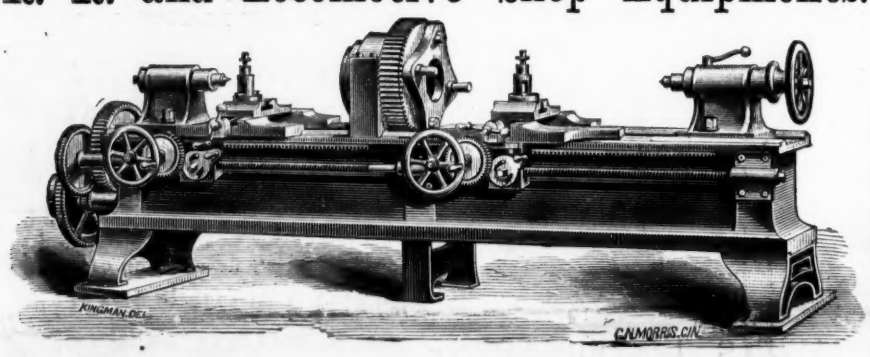

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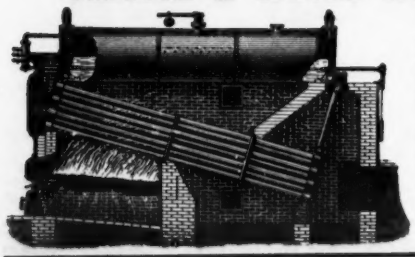

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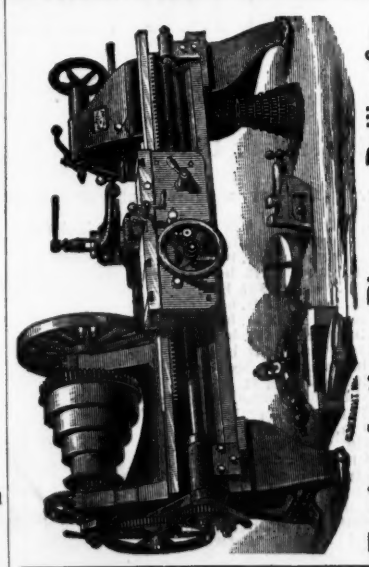

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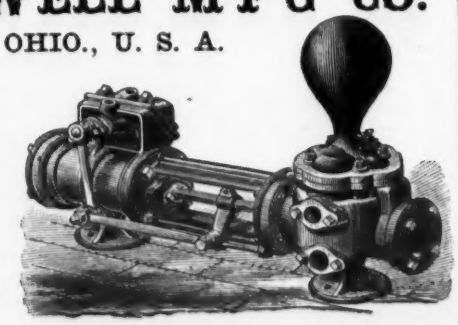

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